JANUARY, 1949 TWO SHILLINGS

TECHNOLOGY DEPARTMENT

Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

IC LIBRARY
1/- 1949

Sigma Instrument Co., Ltd.

PERSPEX ACRYLIC SHEET

Wherever a clear, tough and dimensionally accurate instrument casing is needed, "Perspex" acrylic sheet can be recommended.

IMPERIAL CHEMICAL INDUSTRIES LIMITED

ICI

P.306c

VR v.13 Jan.–July 1949

Send for the

BEXOID REGD

MOULDING POWDER

Key to Colour

YOU will find the very shade for the purpose in this Bexoid colour swatch. It is available to all users and prospective users of 'Bexoid' Moulding Powder — the standard all-round injection material. With a range of applications extending from aircraft and motor-car accessories to toothbrushes, dress ornaments and toys. 'Bexoid' Moulding Powder is adaptable to all injection moulding machines and is available in varying grades, in five degrees of flow. The BX Technical Development Service will gladly and freely advise on any application question.

BX

LEADERS IN THERMO-PLASTICS

HEAD SALES OFFICE:

BX PLASTICS LTD · HIGHAM STATION AVENUE · LONDON · E.4

Telephone: LARkswood 4491.

AREA SALES OFFICES: King Street Buildings, 1 Ridgefield, Manchester 2. *Telephone: Manchester, Blackfriars 0258.* 42 Wellington Street, Sheffield. *Telephone: Sheffield 25517.* Empire House, 159 Great Charles Street, Birmingham 3. *Telephone: Central 2365.* Works: London, Manningtree, Dundee.

TAYLOR 2153

Tech.

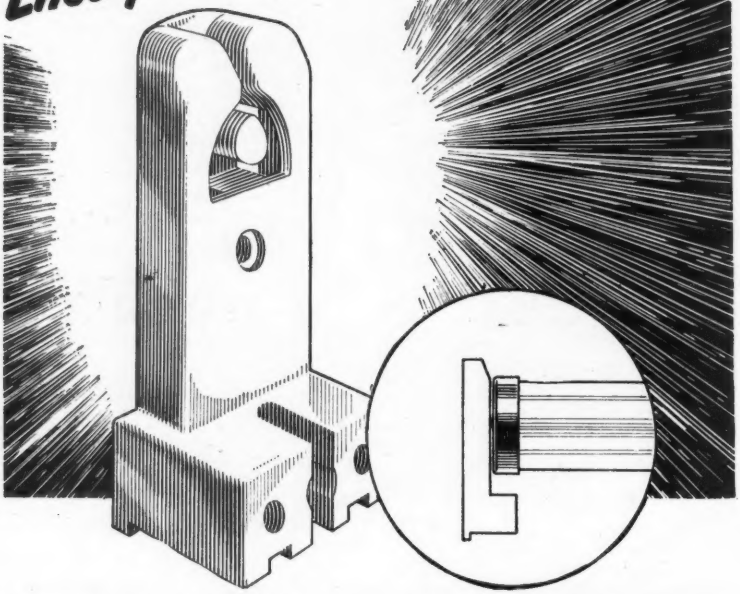
"*Great idea that of Lorival's—to make it in plastics! . . . No need to worry more about it now.*"

Our comprehensive service includes the design, tooling and quantity production of plastics or ebonite. Our wide experience is available to all manufacturers.

LORIVAL PLASTICS

UNITED EBONITE AND LORIVAL LIMITED, U E L LITTLE LEVER, NEAR BOLTON, LANCS.

Ekco plastics in a new light



Ekco mouldings make an important contribution to the efficiency of fluorescent lighting. The lamp-cap and lamp-holder shown are typical of the mouldings which Ekco Plastics are now producing for this new form of lighting. The specification called for great accuracy in tool making and the intricate shape of the lamp-holder shoulders necessitated a high degree of finishing skill. Our technicians and tool makers proved how right were lighting engineers to turn to Ekco Plastics — and how right you will be to consult our Advisory Service on your Plastics problems.

Ekco Plastics **EKCO** *for Industry*

TECHNICAL NOTE: The lamp-holder is moulded in polystyrene giving a good appearance with stability and sufficient flexibility to hold a tight fitting lamp. The mouldings were produced from multi-impression tools: the specification calling for an accuracy of — .002. For a full appreciation of the service we can offer, send your moulding problems to: —

E. K. COLE LTD · EKCO WORKS · SOUTHEND-ON-SEA

The Plastics Mark is on "ROCKITE" materials

From the 1st January 1949, "Rockite" phenolic moulding powders, conforming to B.S. types G, GX, MS, and MHS are being supplied, under licence of the British Standards Institution, in sealed containers bearing the Plastics Mark as certification of their rigid adherence to specification. The letters AB, which appear to the right of the symbol, are the official coding for the products of the licensed manufacturers, British Resin Products Ltd.

"ROCKITE"

Phenolic Moulding Powders

"Rockite" is a Registered Trade Mark of

BRP BRITISH RESIN PRODUCTS LTD.

21 St. James's Square, London, S.W.1. Telephone: Whitehall 8021 (7 lines)
Telegrams: Forresins, Piccy, London. WORKS: Tonbridge, Feltham, Radcliffe, Barry (under construction).

Absolutely First Class Secondhand MACHINERY

I was at my wits' end for certain Plant and Machinery, and someone said "Try 600." I did so, and wish I'd done it years ago! An amazing selection of first class machines, in excellent order. And all I wanted delivered 'off the peg' so to speak. If you want good Plant quickly, the best thing you can do is just what I did—try 600!

Our Stocks include:

Plastic Moulding and Rubber Machinery, Pans, Mixers, Filter Presses, Centrifugals, Vacuum Pumps, Stills, Condensers, and every class of Chemical Plant, Steam and Diesel Engines, Electrical Plant, Boilers, Pumps, Air Compressors, Hydraulic Plant, Locomotives, Cranes, Track and Wagons, Tanks, Steel Sections, Tubes and Fittings, and every kind of Modern Secondhand Works' Equipment.

ONE OF THE 600 GROUP OF COMPANIES

GEORGE COHEN SONS & CO. LTD

Established 1834

WOOD LANE, LONDON, W.12, AND STANNINGLEY, Nr. LEEDS

'Phone: Shepherds Bush 2070 *'Phone: Pudsey 2241*
'Grams: Omniplant, Chisk, London *'Grams: Coborn, Leeds*

And at Birmingham · Newcastle · Sheffield · Glasgow · Dunfermline · Manchester · Swansea
Southampton · Bath · Belfast

P/488/P91

A NEW *Plastics* CALENDER

for the needs of the present an investment for the future

By BRIDGE

A Post-war development embodying many new features in Calender design.

(WRITE DEPT. A)

DAVID BRIDGE & CO. LTD. CASTLETON. ROCHDALE
ENGINEERS TO THE RUBBER & PLASTICS INDUSTRY

THE "Painted" WORD

-PREFABRICATED

One of the less obvious uses of 'Trapinex' Paint Printing and of 'Trapinex' Paint Transfers has been their application to the electric control unit used in prefabricated houses. This consisted of "paint" printing direct on to the metal outer cover and on to the inner plastic fuse box, as well as the alternative method of 'Trapinex' Transfers where preferred—both methods being approved by the Ministry concerned. A simple, efficient and durable method of applying permanent directions, diagrammatic instructions, or wiring layouts to plastic or any other smooth surface. Plastic industries can find extensive use for the advantages which "paint" printing has over printers' ink. Brilliant colours in any number, weather-resisting durability, fastness to sunlight, and unlimited design are recommendations which have established the popularity of 'Trapinex' Paint Processes—Direct Printing and Patented Transfers—for publicity, display and packaging on plastics of all varieties.

Let us send you specimens and an 8-page brochure on the Story of "Trapinex" Transfers showing their many vital uses in war and peace.

Advice freely given, but when you write for prices please state (1) Size, (2) Quantity, (3) Number of Colours, (4) Purpose, (5) Wording required, (6) A rough sketch would help. WE HAVE NO STOCK LINES OR PRICE LISTS.

Ready for use in Workshop, Factory, Office . . . for Nameplates, Brand Marks, Monograms, Patent Numbers, Instructions, Diagrams, Wiring Layouts, Warnings, Type, Catalogue or Serial Numbers.

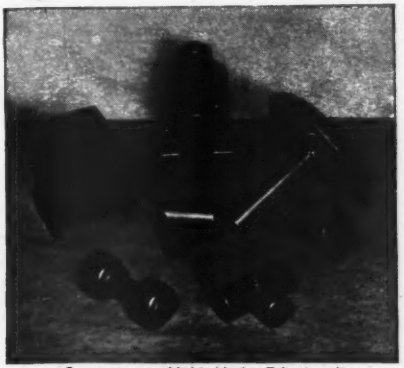
TRAPINEX *Paint* **PROCESSES**

Trapinex (Regd.) Paint Transfers are fully patented and manufactured only by :—
TRAPINEX LTD., 2 COMMERCE HOUSE, HIGH ROAD, WOOD GREEN, N.22 (Opposite Town Hall)
Phone : Bowes Park 6811/3. Grams : "Trapinex, Wood, London." Cables : "Trapinex, London."

TELCOTHENE
REGD.
THERMOPLASTIC MOULDINGS

TELCOTHENE—a thermoplastic material having a polythene base—can be profitably utilised where superior electrical characteristics and chemical inertness are required. In addition, the properties of low moisture permeability, mechanical robustness, particularly at sub-zero temperatures, and the absence of toxic fillers make it a desirable product in many industries.

Moulded insulators in natural "TELCOTHENE" incorporate metal inserts.



Components moulded in black "Telcothene"

Bottles, funnels, beakers, etc., for laboratory use.

TELCON

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD.

Founded 1864

Head Office: 22 OLD BROAD ST., LONDON, E.C.2
Telephone: LONdon Wall 3141

Enquiries to: TELCON WORKS, GREENWICH, S.E.10
Telephone Greenwich 1040

Serve – with a sprinkling of nuts – to engineers who say that *all* small power tools get too hot to handle. Point out that some power tools – no names mentioned – are worked by little horses who keep cool even when running for hours on end at a perfectly furious pace. Remind discreetly—when presenting the bill—that bigger horses are known to get hot under the collar at the mere thought of such activity.

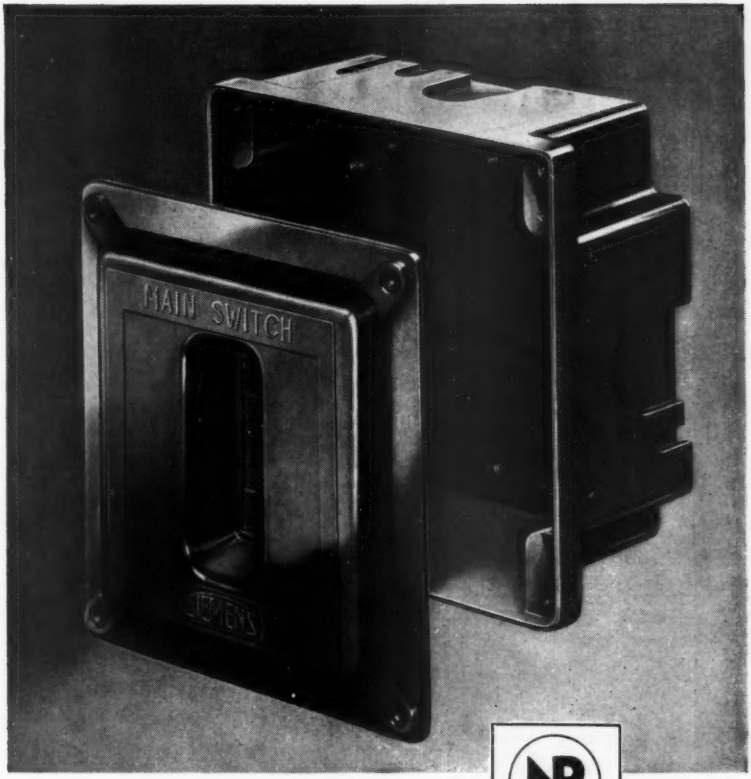
Specialists in Lightweight Pneumatic and Electric Portable Tools.

DESOUTTER

DESOUTTER BROS. LTD., THE HYDE, HENDON, LONDON, N.W.9.

COLINDALE 6346-7-8-9 GRAMS: DESPNUCO, HYDE, LONDON.

C.R.C.193



main switch box and cover, for domestic and industrial electrical circuits, made for Siemens Brothers & Co. Ltd. . . . by

NP

A NATIONAL PLASTICS COMPANY

MOULDED PRODUCTS LTD. . . *Birmingham*

CHESTER ROAD · TYBURN · BIRMINGHAM · 24

MP107

SAGAR Specialists in Woodworking Machinery

Send their

GOOD WISHES TO YOU

and smooth running

to speed success

in 1949

J. SAGAR & COMPANY LIMITED
CANAL WORKS HALIFAX . LONDON . BIRMINGHAM

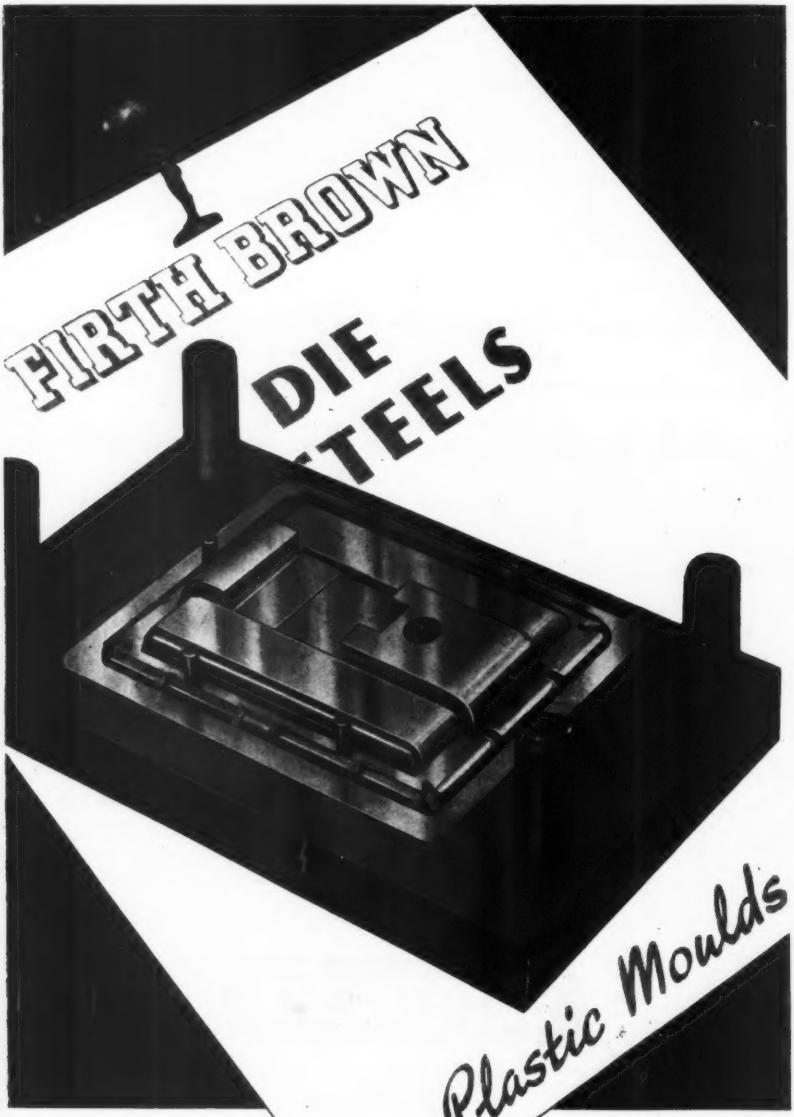
Crystalate Activities

THE ACTIVITIES OF THE CRYSTALATE GROUP OF COMPANIES EMBRACE THE APPLICATIONS FOR ALL TRADES OF MOULDED PLASTICS (BY COMPRESSION, TRANSFER AND INJECTION); FABRICATED, MACHINED AND STAMPED PLASTIC LAMINATED MATERIALS; LAMINATED PAPER AND FABRIC BASE TUBES, BOBBINS AND FORMERS; MICANITE TUBES; MICA, MICANITE AND PRESSPAHN INSULATIONS; BAR COVERING; CAPSTAN LATHE PRODUCTION; FABRICATION AND MOULDING OF "PERSPEX" (Acrylic Sheet); MOULD, TOOL AND JIG MAKING AND PRINTING.

CRYSTALATE

Crystalate Ltd., Golden Green, Tonbridge, Kent. *Phone: Hadlow 233/4/5 (20 lines)*

PLASTIC MOULDERS, FABRICATORS & TOOL MAKERS SINCE 1899



FIRTH BROWN STEELS LTD., SHEFFIELD

We had designs on this customer

Some weeks ago a customer came to us with a complicated blueprint for a plastic moulding. The design presented certain difficulties, so we suggested amendments which the customer accepted. Thereupon, he told us to go ahead and make the necessary adjustments, which we did. It is because we firmly believe in this kind of close co-operation between the customer and our experts that we are able to keep on turning out plastic mouldings of the highest order.

If you want to know what plastics can do for you
ask **Ashdowns**

ASHDOWNS LIMITED, ECCLESTON WORKS, ST. HELENS, LANCS Phone: St. Helens 3206
(Ashdowns is a subsidiary of Pilkington Brothers Ltd.)

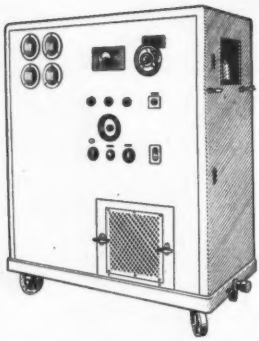
IS HIGH FREQUENCY HEATING THE ANSWER TO YOUR PROBLEM?

Experience has shown that the introduction of High-Frequency heating into the manufacture of numerous diverse products has resulted in great savings in production time, labour, space and often in materials, as well as a marked improvement in the quality of the manufactured product.

BUT it is not in ***every*** case that H.F. Heating can be introduced to advantage.

As manufacturers and suppliers of a wide range of equipment for all industrial heat treatment processes, the G.E.C. is clearly in a position to give unbiassed guidance to manufacturers on the uses of high-frequency heating.

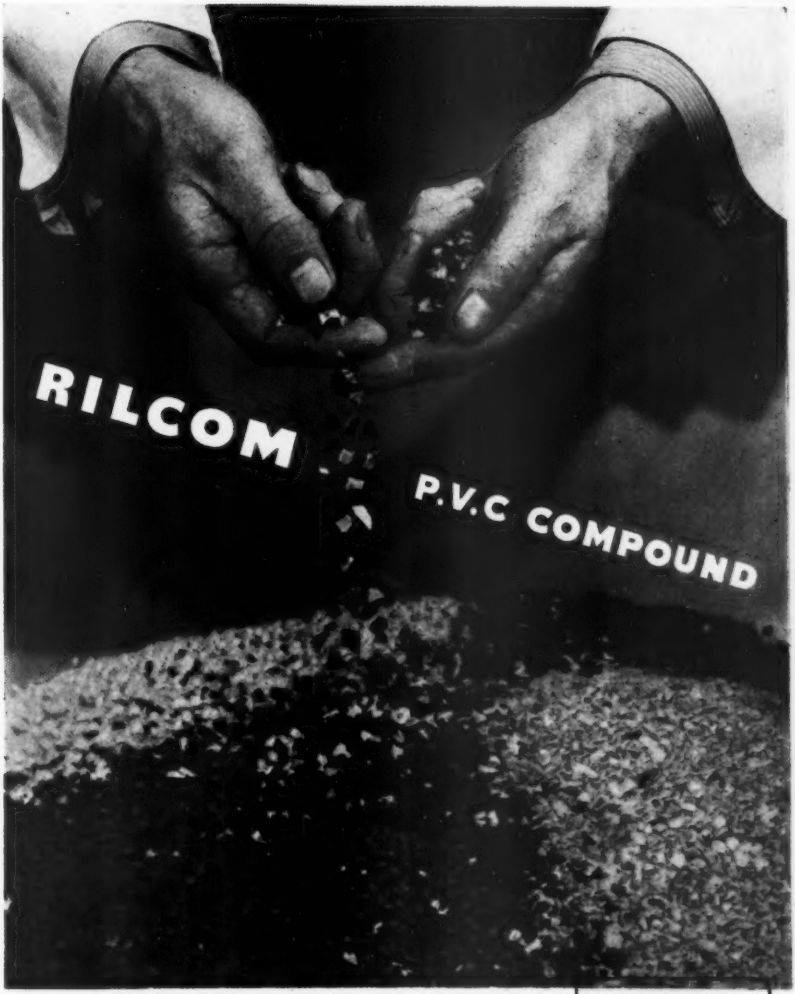
The Process Heating Department of the G.E.C. is ready at all times to advise on all problems relating to industrial heat treatment by High Frequency and other means.



HIGH FREQUENCY HEATING

by G.E.C.

The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2



Also Manufacturers of **RILOTEX P.V.C. PASTES**

Rubber Improvement Ltd.

LEONEX WORKS · HYTHE RD WILLESDEN · LONDON N·W·10

Telephone:- LADBROKE 2454 *Telegrams:-* "RUBBERLAND, HARLES, LONDON"

RILEX WORKS, LONDON RD, WELLINGBOROUGH, NORTHANTS.
Telephone:- WELLINGBOROUGH 2218

NORTHERN AREA OFFICE:
196 DEANSGATE, MANCHESTER
Telephone: BLAckfriars 7380

Leonex

Many industrial problems have been answered by 'Celastoid' (cellulose acetate) Tubing because of all-round adaptability. As a colourful covering for metal or wood inserts, 'Celastoid' Tubing is ideal: it does not chip, crack or snap, polishes easily and retains a high gloss finish. In various colours, also black, white and ivory.

'Celastoid'
TRADE MARK
TUBING
BRITISH CELANESE LIMITED
Plastics Department, Celanese House, Hanover Square, London, W.1

QUALITY

in QUANTITY

A A All Bakelite moulding materials designed to comply with B.S. 771 are now being marked with the British Standards Institution Certification Mark.

A A There will be no change in the quality of our materials, which in fact have been made to these same high standards for many years.

A A The Certification Mark provides formal confirmation of the continuance of the same high standards of Bakelite quality that customers expect.

AA is our code reference number which will appear on each drum of certified powder.

TREFOIL

BAKELITE PLASTICS

REGD. TRADE MARKS

Essential Materials for Essential Work

BAKELITE LIMITED · 18 GROSVENOR GARDENS · LONDON · S.W.1

DETROIT PUBLIC LIBRARY

PRODUCTS AND GOODWILL well and truly welded

★

The design of fancy goods is not our pigeon, but trust Redifon Welding to take care of criticism as far as joints and seams are concerned. Neatness and strength will be entirely self-evident. Trust Redifon Welding, too, to make itself felt in speeding up production and minimising overheads. Full details if you ring Putney 5691.

Redifon HEATING

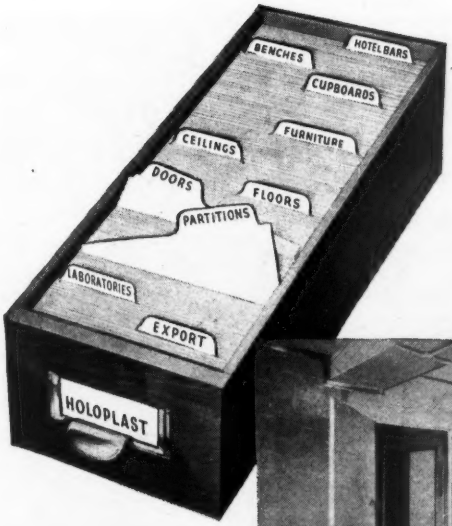
INDUSTRIAL ELECTRONICS DIVISION

REDIFFUSION LIMITED

BROOMHILL ROAD, WANDSWORTH, LONDON, S.W.18

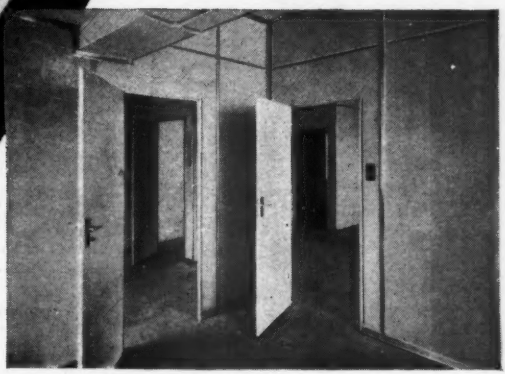
Designers and Manufacturers of Industrial Electronic and Radio Communication Equipment

RH2



FLUSH DOORS

"Holoplast" laminated structural plastic panels can be used for the construction of doors of all sizes up to 8 ft. x 4 ft.



By courtesy of the Anglo-American Corporation of South Africa.

In the forefront of plastic achievement

A standard sized door can be cut direct from the 8 ft. x 4 ft. "Holoplast" panel and mounted on an extruded aluminium frame in the surrounding panel, the cavities of the panel offering excellent concealment for the lock fittings.

Doors made from "Holoplast" are :

STRONG and RIGID	RESISTANT TO FIRE
SOUND INSULATING	HEAT INSULATING
HYGIENIC	DECORATIVE
RESISTANT TO VERMIN	EASILY FABRICATED

SUITABLE FOR ALL CLIMATES

HOLOPLAST LTD.

Head Office and Works: NEW HYTHE, Near MAIDSTONE, KENT

Authorised Distributors for the United Kingdom :

Gliksten Plastics	**L. Kelzer & Co., Ltd.**	**Metropolitan Plywood Company**
Venesta Limited	**Denny, Mott & Dickson Ltd.**	**Gabriel, Wade & English Ltd.**

CM34a

AIRMEC

the most advanced Electronic Heat Generator yet produced

Designed to meet the demand by production engineers for a more compact Heat Generator, the Airmec embodies latest electronic practice and is available in 5 kW and 2 kW models, both ideally suitable for dielectric heating of plastics. Suitable work boxes for plastic pre-heating are available for mounting in cabinet. They are the most compact units of their power rating.

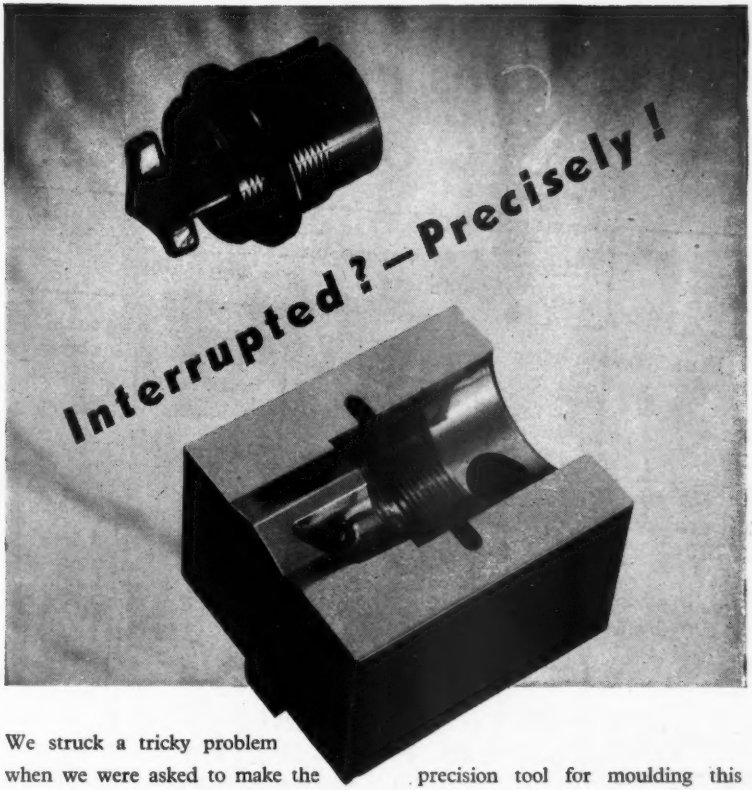
Specification includes latest type airblast cooled oscillator valve, electrical and mechanical interlocks, efficient protection of electrical circuits against overloads. Repetition work by unskilled workers is facilitated by a full vision automatic self-resetting process timer, and automatic control with locked settings.

Both models are clean and attractive in appearance, finished in cream enamel. List GA157 explains fully the high standards reached in our equipment — we will gladly send you a copy and follow it with advice on any production problems you may care to raise. Please do not hesitate to ask.

AIRMEC LABORATORIES LTD

CRESSEX, HIGH WYCOMBE, BUCKS. Tel. : High Wycombe 2060

Manufacturers of all types of industrial electronic equipment and test gear



We struck a tricky problem when we were asked to make the precision tool for moulding this lampholder incorporating an interrupted thread. As always when a standard machine cannot do the job — or will not do it economically — we set about designing equipment that will. Result? An ingenious adaptation to a standard lathe which, by a roller and cam action operating through a linkage, automatically withdraws the cutter at pre-determined intervals. The precision with which it cuts the threads in the split die is reflected in the accurately formed finished moulding.

Enquiries are invited from moulders and mould makers who require:

THE ULTIMATE IN PRECISION

B·I·P TOOLS LIMITED

B·I·P GROUP

TYBURN ROAD, ERDINGTON, BIRMINGHAM 24

Telephone: Birmingham East 2061 · Telegrams: Plasmould Birmingham 24

Hycar leads in oil-resistance!

Fluid	Temp. of Test	% increase in volume on immersion in oils and petrols for seven days			
		HYCAR OR-15	Another nitrile copolymer	Chloroprene polymer (no second component)	Natural Rubber
		%	%	%	%
Mineral Oil DTD44D	70°C	1	9	23	swells 200+, becomes sticky, tends to disintegrate
Transformer Oil	70°C	-1	5	21	
Diesel Oil	70°C	9	30	87	
Paraffin	70°C	6	18	55	
Petrol (100 octane)	25°C	5	23	52	250+
Petrol (high aromatics)	25°C	18	42	107	300+

The properties of butadiene copolymers depend upon the nature of the second component. In butadiene/acrylonitrile copolymers the acrylonitrile confers oil resistance to a degree controlled by its content in the copolymer. The percentage of acrylonitrile is highest in Hycar OR-15. This gives Hycar OR-15 its super-resistance to oils and petrols.

Hycar
Synthetic Rubber

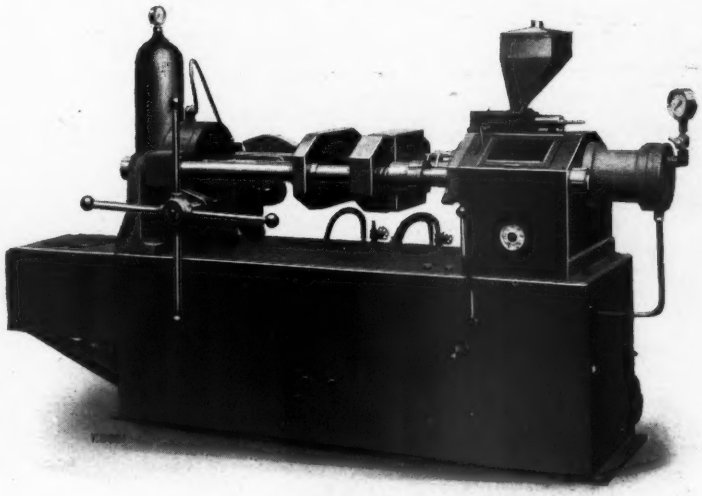
British Geon Limited

Sales Office: 21 St. James's Square, London, S.W.1.

Telephone: Whitehall 9561 (5 lines)

HERBERT

FOR THERMO-PLASTICS . . . .



. . . THE EDGWICK TYPE "HY" INJECTION MOULDING MACHINE

- Built exclusively for us by T. H. & J. Daniels Ltd., Stroud
- Moulding capacity - - - - 1½ oz.
- Area under pressure - - - - 8 sq. ins.

COME AND SEE FOR YOURSELF—AVAILABLE FOR EARLY DELIVERY

FOR FURTHER PARTICULARS WRITE TO FACTORED DIVISION, RED LANE
PHONE : 89221 (10 LINES)

ALFRED HERBERT LTD · COVENTRY

SOLE AGENTS FOR PLASTICS MACHINERY IN GREAT BRITAIN, INDIA, FRANCE AND ITALY FOR:
T. H. & J. DANIELS LTD., STROUD, GLOS.
REED - PRENTICE CORPORATION, WORCESTER, MASS, U.S.A.

In Cellulose Acetate...

it's an invitation to buy

Crystal-clear cellulose acetate is now freely available for the manufacture of elegant containers or toys. This durable yet dainty material is quickly and easily moulded into superior containers of any shape or size which display products in the most inviting way. Toys made from this versatile substance are safe and ideal for youngsters.

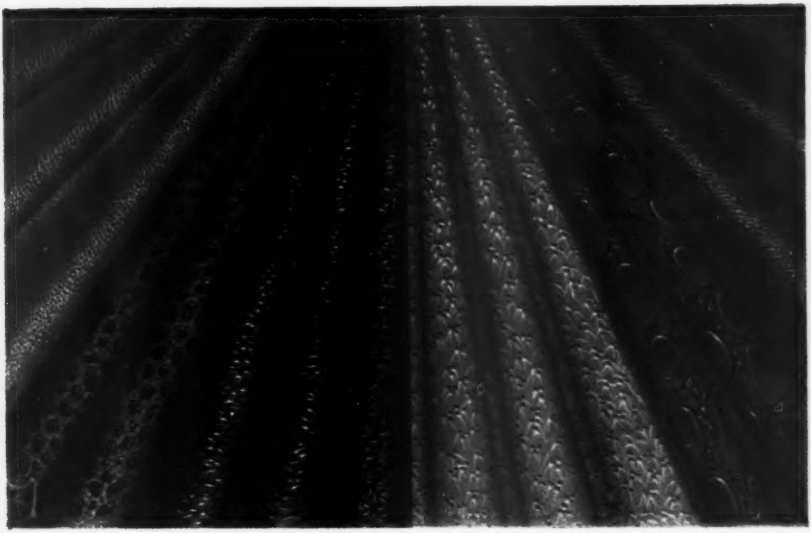
Cellulose acetate can be tinted, embossed, printed or left with its natural sparkle.

★ *We welcome your enquiries for Cellulose Acetate which we make in rolls and sheets in all thicknesses from* .001 *to* .010 *inches.*

DUFAY-CHROMEX LTD.

14-16, Cockspur Street, Westminster, London, S.W.1. Tel.: WHitehall 6747

DURAPLEX P.V.C. EMBOSSED SHEETING



HOME and EXPORT

DURAPLEX (PLASTICS) LIMITED

BURWOOD HOUSE, CAXTON ST., LONDON, S.W.1

Telephone: WHItehall 2980 & 2989 *Cables: Polyvyn, Sowest, London*

ALSO SOLE DISTRIBUTORS for their ASSOCIATE COMPANIES

G.B.W. CHEMICALS LIMITED

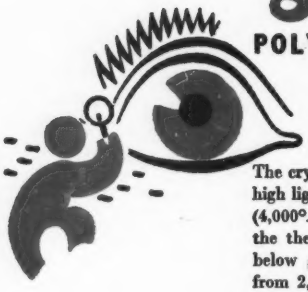
Manufacturers of P.V.C. COMPOUNDS *designed to meet all requirements in the* PLASTIC, CABLE & ALLIED INDUSTRIES

DURAPLEX INDUSTRIES LIMITED

Processors of P.V.C. by Calenders, Spreaders and Extruders

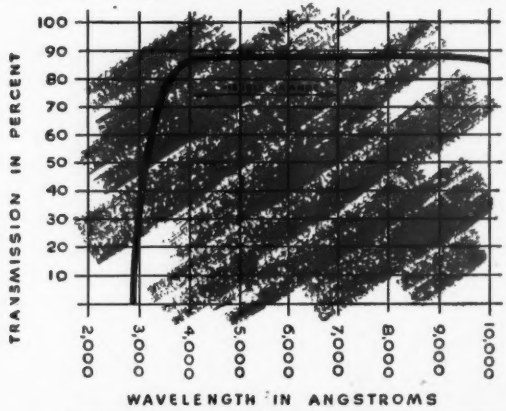
WORKS ADDRESS: INGLIS GREEN RD., SLATEFORD, EDINBURGH 11

THE OPTICAL PROPERTIES OF MONSANTO Lustron POLYSTYRENE MOULDING CRYSTALS



ensure sparkling transparency, translucence, or opaqueness throughout the entire range of Lustron colours.

The crystal clarity of transparent Lustron is illustrated by its high light transmission, 88 to 90 per cent, in the visible region (4,000°A.—7,000°A.). Because of high refractive index (1.59), the theoretical transmission is only 92 per cent. The chart below gives the light transmission of Lustron in the region from 2,000°A. to 10,000°A. determined on slabs 0.10" thick. An interesting property of Lustron is internal reflection. Parts moulded of Lustron carry light and in effect "pipe" it. This light glows only at edges or at points where the surface is disturbed.



Percent Ultimate Elongation vs. Temperature of Lustron

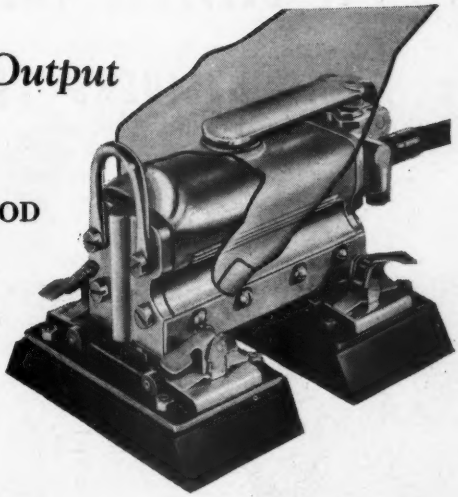
MONSANTO CHEMICALS

QUICK FACTS ABOUT LUSTRON . . . Low cost per pound . . . Lightweight . . . Faster moulding . . . New brilliance and clarity . . . No taste or odour . . . High dimensional stability . . . Good chemical resistance . . . Excellent electrical qualities . . . Gay colour range.

Write to Plastics Department, Monsanto Chemicals Limited, Victoria Station House, London, S.W.1.

Speed-up Output

THE MODERN MACHINE METHOD FOR SANDING *or* SURFACE PREPARATION FOR *ANY* FINAL FINISH



SUNDSTRAND *Pneumatic* SANDER

FOR a beautiful finish, use the SUNDSTRAND pneumatic SANDER. Portable, light and easy to use, it will speed-up output and reduce operating costs. It is completely free from vibration. It can be used in awkward places and on flat, convex or concave surfaces. The pads reciprocate in opposite directions, thus eliminating end-thrust "travel."

The Sundstrand can be used for either wet or dry sanding. It is automatically lubricated and interchangeable pads for various needs are available when sanding or finishing wood, metal, plastic and composition materials.

The ideal machine for removing blemishes, scratches and other surface defects, by use of suitable abrasives and finally by polishing to restore original surface and lustre. Also for removing "Flash" and other mould marks and for final polishing of mouldings.

Write for details and demonstration to Dept. P/1

SUNDSTRAND PNEUMATIC SANDERS (BRITAIN) LTD.
CHURCH STREET, SHIPSTON-ON-STOUR, WARWICKSHIRE. Tel. 110
15, PARK CRESCENT MEWS EAST, LONDON, W.1. Tel. WELbeck 7589 and 3025

IT DELIVERS THE POWER

THAT DELIVERS THE GOODS

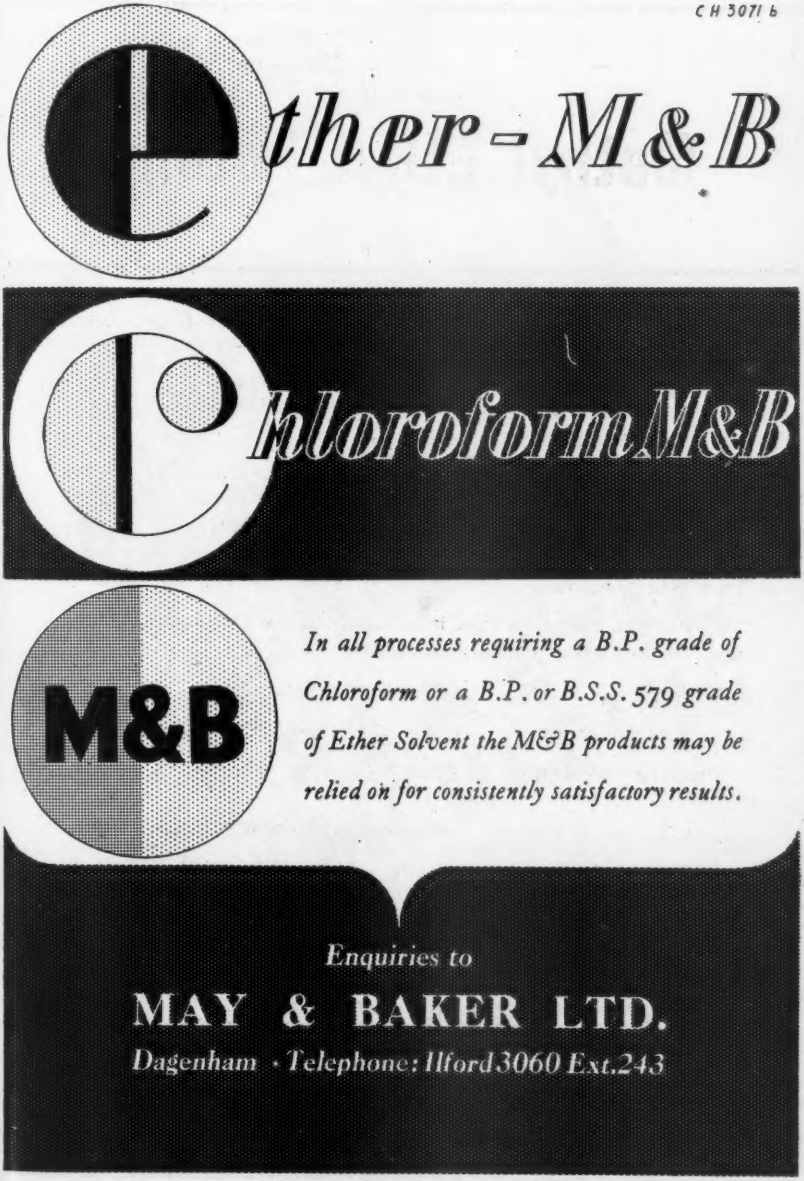
ANDREW FRASER
AND COMPANY LIMITED

29 BUCKINGHAM GATE, LONDON, S.W.1

Phone: VICtoria 6736/9. Grams: Monorad, Sowest, London.

MONO-RADIAL HYDRAULIC PUMPS

CH 3071 b


Ether-M&B
Chloroform M&B
M&B
In all processes requiring a B.P. grade of Chloroform or a B.P. or B.S.S. 579 grade of Ether Solvent the M&B products may be relied on for consistently satisfactory results.
Enquiries to
MAY & BAKER LTD.
Dagenham · Telephone: Ilford 3060 Ext. 243

SHELL AIDS TO PROCESSING

Methyl Ethyl Ketone

● METHYL ETHYL KETONE is a colourless, mobile liquid with a characteristic ketonic odour, possessing a moderately low boiling point, a lower rate of evaporation than acetone and good solvent power. It is inert towards metals and does not hydrolyse to acidic products which might give rise to corrosion problems.

METHYL ETHYL KETONE is an excellent solvent for cellulose nitrate, for low viscosity grades of cellulose acetate and for many natural and synthetic resins, especially the soluble vinyl types—which makes it of particular interest in the formulation of surface coatings based upon polyvinyl acetate resins and co-polymers.

Shell METHYL ETHYL KETONE is manufactured to a high degree of purity and conforms to the following specification :

PURITY	Minimum 99% by weight.
SPECIFIC GRAVITY	0.805—0.807 at 20/20°C.
DISTILLATION RANGE (A.S.T.M. D.268)	Below 79°C.—none. Above 80.5°C.—none.
NON-VOLATILE MATTER	Max. 2 mg. per 100 ml. (0.0025% by weight).

When Shell's newest chemical plant comes " on stream," Shell METHYL ETHYL KETONE will be obtainable in quantity. Meanwhile, samples of this very promising aid to plastic processing are immediately available for experiment and evaluation.

SHELL CHEMICALS LIMITED
(DISTRIBUTORS)

SHELL

112, STRAND, LONDON, W.C.2 TEL: TEMPLE BAR 4455

PL3

DIE STEELS *for* PLASTIC MOULDING

The ESC folder, reference PLM.1/2, contains details of steels eminently suitable for present needs.

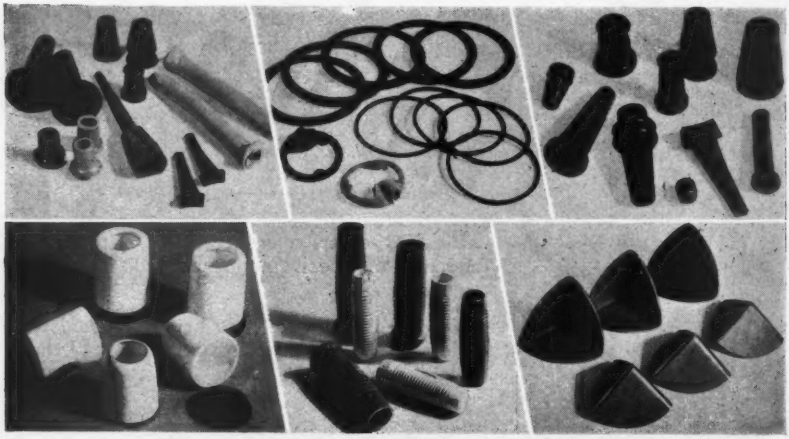
New steels, however, are being designed to meet the special problems arising out of the rapid development in the Plastics Industry.

ENGLISH STEEL CORPORATION LIMITED

OPENSHAW MANCHESTER 11

UTILEX LIMITED
MILL STREET, KINGSTON-ON-THAMES Telephone: Kingston 1660

PLASTIC MOULDINGS OF ALL TYPES



J. F. KENURE LTD., FELTHAM, MIDDLESEX

Sterling Moulding Materials

LIMITED

Can now offer
prompt delivery
of BRITISH produced

PHENOLIC MOULDING POWDERS

All grades

PHENOLIC SYNTHETIC RESINS

INCLUDING:
Novolaks
Laminating Resins
Adhesives

PAINT RESINS

INCLUDING:
Modified Phenolic
Ester Gums
Urea Lacquer Resins

CELLULOSE ACETATE MOULDING POWDERS

P.V.C. COMPOUNDS AND PASTES

We can also offer
supplies of imported :—

UREA FORMALDEHYDE &
POLYSTYRENE MOULDING POWDERS

For Home and Export Trades

STERLING MOULDING MATERIALS LTD. 11 OXFORD CIRCUS AVENUE, LONDON, W.1.
PHONE : GERRARD 2931 CABLES : STERMOLD, LONDON

REWORKED, REGROUND MATERIALS Reduce Costs

★ Use DOHM for pulverising, mixing and grading. Six plants at your service.

★ Use DOHM reprocessed or reground thermo-plastic moulding powders.

★ Write DOHM to-day: our methods and materials will make your quotations competitive.

DOHM LTD
PLASTICS DIVISION

167 VICTORIA STREET
LONDON, S.W.1

Telephone:
Victoria 1414/5/6 and
Victoria 7913

SIX FACTORIES

Mouldings that matter

Our long experience in the design and production of intricate precision mouldings ensures that these moulded bobbins, for use on knitting machines, reach an unusually high degree of strength, uniformity and finish.
Difficult mouldings of this nature can safely be left to Kent Mouldings.

As supplied to I.L. BERRIDGE & CO., LEICESTER, for use on their knitting machines.

KENT MOULDINGS KM FOOTSCRAY, SIDCUP, KENT

STYRON

Polystyrene Moulding Granules

manufactured by

DOW CHEMICAL OF CANADA LTD.

The **RIGHT** Plastic
for injection, compression and extrusion
in a full range of standard colours, and
NEW IMPROVED CRYSTAL

●

R. H. COLE AND COMPANY LIMITED
2, CAXTON STREET, WESTMINSTER, S.W.1
Phone: Whitehall 0711/2/3 and 7193/4 Grams: Geratole, Phone, London

THIS WAS THE PROBLEM

The rapid, accurate production of ball-bearing cages that would function in bearings running at unusually high speeds with minimum attention to lubrication.

—solved by moulding in BAKELITE MATERIAL

The machining of these Skefko cages from solid would be a skilled and costly operation. By moulding in BAKELITE special impregnated fabric material FB 5396 a lengthy job was reduced to simple repetition work in which the 50,000th cage could be relied on to be identical with the first . . . light, strong, wear-resistant and indifferent to under-lubrication.

* * *

Mouldings produced for the Skefko Ball Bearing Co. Ltd. by United Ebonite & Lorival Ltd.

TREFOIL

BAKELITE PLASTICS

REGD. TRADE MARKS

Essential Materials for Essential Work

BAKELITE LIMITED · 18 GROSVENOR GARDENS · LONDON S.W.1

Vol. XIII. No. 140. JANUARY, 1949

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - **TEMPLE PRESS LIMITED**
Chairman and Managing Director **ROLAND E. DANGERFIELD**

Editor - - - **M. D. CURWEN, B.Sc., A.R.I.C.**
Offices - - **Bowling Green Lane, London, E.C.1**

CONTENTS

	Page
Editorials	2
Novel Plastic Covering Strip	5
Design for an Injection-Moulded Fruit Bowl ..	6
The Plastics Industry in India	10
A New Laminate for Merchandise Crates	11
World's Industry Employs Plastics	12
Cellulose Acetate Plastics, by Vivian Stannett and R. Whitfield	15
Applications of the Plastic Replica Process to Surface Finish Measurement, by C. Timms and C. A. Scoles	24
Injection Moulds and Mouldings	29
Marking Process and Media for Plastics, by E. E. Halls	30
Letters	36
Production News	37
New Productions from the Moulding Shops	39
Quality Control in Plastic Moulding, by W. M. Halliday	40
Microscopic Examination of Plastic Materials, by J. H. Wredden	45
Patent Review	52

NOTICES

"PLASTICS" is published monthly in London, England.
Annual subscription rate 26/-. Shorter periods pro rata.

All instructions, matter and passed proofs of all kinds of advertisements must reach the Head Office of "PLASTICS" by the 24th of preceding month to ensure insertion.

Head Offices:
Bowling Green Lane, London, E.C.1.
Inland Telegrams - "*Pressimus, Phone, London.*"
Cables - - - - - "*Pressimus, London.*"
Telephone - - *Terminus 3636 (Private Exchange).*

Midland Offices—5, Suffolk Street, Birmingham, 1.
Telephone - - - *Midland 4111-8.*
50, *Hertford Street, Coventry.*
Telephone - - - *Coventry 62464.*

Northern Offices—1, Brazennose Street, Manchester, 2.
Telephone - - *Blackfriars 5038-9.*

Scottish Offices—12, Renfield Street, Glasgow.
Telephone - *Glasgow Central 9036.*

EDITORIALS

Design—And All That

AT odd and rare intervals in the world's plastics Press there have appeared articles on designing for plastics, and at this stage certain clearly defined general principles have been laid down, and should be followed if good and economically sound mouldings are to be made. On the whole they describe the snags to avoid, where undercuts may or may not be feasible, the minimum-sized radius to produce at an edge and much other like data. They are the simple principles (almost purely engineering principles) which are found as a result of experience by any worker without the aid of an artist-designer.

At the other extreme "it is all artist-designer" when it comes to the design of an engraving on, say, "acrylic" sheet or the decoration of a laminated sheet, but this is merely transfer of his art of wood-carving or painting.

In between these two aspects of design lies his new field.

It would be impertinent for us to suggest that there might be frontiers over which his influence cannot be felt, but up to the present, at any rate, we presume that the severely technical moulding can get little help from him. Much electrical apparatus, engineering and chemical plant, from industrial or other fans and gear wheels to textile bobbins and accumulator casings, have been designed as completely and satisfactorily by the mathematician or engineer, as have the yacht or sledge-hammer, which latter may not be æsthetically lovely yet is admirably functional. There are also very many mouldings which are merely mathematically exact or near copies of objects originally made in metal, wood or other traditional materials, deriving advantages from the simple facts of lightness, incorrodibility, transparency, etc. Alternatively, the moulder has been able, because of the ease of flow of plastic compounds, to produce in one piece instead of a multitudinous hitching together of metal parts.

Be this as it may, the field before the artist-designer is big enough, and providing he has a basic knowledge of moulding technique and of the properties of plastic materials, his help is of paramount importance in a vast range of goods that stretches from fancy goods and toys to razor-casings and refrigerators, from packaging to furniture, and from household goods to radio cabinets or automobile equipment—in fact, almost all those myriads of objects that are seen or used by the public.

If the need for the artist-designer in the plastics industry is of the high importance we believe it to be, for our own economic salvation it seems a great pity that so many of us still have very hazy ideas as to what the designer is after. Obviously he is trying to marry true art with mechanics, and obviously we know, albeit in a vague way, that he has often succeeded in doing so. Is there not a more precise way of imparting to us some indication of his knowledge and skill?

We do not wish to be taught how to become artists in six lessons. We do not even expect to be taught the difference between good art and bad art, but if we could achieve some appreciation of it or an inkling of what goes on in the mind of the artist-designer when creating something new, we might receive a mental shake-up that would make us more appreciative of his job.

At rare intervals before the war there appeared in the Press reasoned criticisms of finished mouldings from both the æsthetic and engineering points of view by artist-designers. While such criticisms were important and valuable, the type had its weakness for the simple fact that there was no continuity in them—a result due, perhaps, to the sensitivity on the part

of the moulders or perhaps uncertainty by the critic at such an early stage of the application of art in industry. We say such criticisms were valuable, but we believe they were more valuable to the world of art than to the world of the plastics moulder.

With the view we have in mind, that the artist-designer must tell us something of his ideas, we are publishing on page 6 an article which may prove of value in this respect. It is, we believe, entirely novel, for it consists of an interview with Mr. George Fejér, the well-known designer, who wrote so many articles for this journal during the war and post-war years on the modern design of plastic furniture. In this interview we asked him a number of questions regarding a design of his own. These, together with his answers, make interesting reading.

How far we succeed in rousing general interest with this elementary beginning remains to be seen. Certainly to us (whose appreciation of art and its methods is merely expressed by the phrase, "We know what we like," and which almost certainly means we do not know why we like anything) the experience was a fascinating one.

If it encourages other artist-designers to give us their own views on their own designs we shall be very satisfied, for we are sure we should learn a great deal.

American Plastics

DESIGN appears to occupy our thoughts more than normally because there was seen in London last month a small selection of American plastic productions which won special award in the first post-war competition held under the auspices of the American journal, "Modern Plastics." Those readers who can obtain a copy of its September issue, in which all the prize-winning mouldings and fabrications were shown, will learn much to their advantage.

There is one comment to make first—the exhibition of them in London described the competition as one of "design." We can find no mention of this in the above issue, but to the word "application." Therein lies an important difference, especially since in pre-war days the competitions were definitely described as design.

As may be well known, the competition was divided into sections, such as building equipment and materials, communications, displays, electrical apparatus, furniture, hardware, industrial, medical, houseware, and so on.

Almost all the objects are beautifully executed, the mouldings especially showing how high is the standard of American technique. The toys are a joy to handle, and British workers would learn much, especially in the method of their presentation, by which we mean the colourful and intelligently decorated boxes which often is a part of the toy set.

A miracle of workmanship is seen in the medical section, where an artificial hand made from vinyl resins is the most life-like we have ever seen.

From the purely design point of view, we ourselves would give first "First Prize," if we can so put it, to the melamine cups and saucers moulded by American Cyanamide Co. to the design of Mr. Russell Wright, a leading designer in ceramic tableware. They are a joy to the eye and the touch. These goods won the "Merchandising Prize."

It was strange to find another prize-winning group of exactly the same objects—cups, saucers, etc., in another section entirely, namely, "houseware." Here, presumably, the award was not for design but for application, the material being of polythene. We have always regarded polythene as being "ideal" for the purpose, especially because of its absolute unbreakability.

But there our admiration of this prize-winner ends. It is interesting that in our August, 1948, issue we noted the cup in an American advertisement and criticized it from design point of view. We reproduce here once more a drawing of it. To recapitulate, here is a cup with a bulbous feature serving in place of the conventional looped handle, and which, we claim, cannot be held, when the cup is full,

between finger and thumb without great strain. What is more extraordinary, a large water-jug of the same design was also on view. Its capacity is nearly a quart; filled with water, it would weigh about 2 lb. Supporting it would entail gripping by clutching in the fist or the use of both hands. Surely this is functionally wrong.

Since American good design will, we hope, be appreciated and perhaps copied here as much as we hope good British design will receive commendation in the United States, we should like to know from the selection committee why they approved of this design, or, alternatively, the depth of our abysmal lack of appreciation of functionality, let alone art.

Colours

THIS imparting of an appreciation of art is one of the most difficult that faces the artist, as any man-in-the-street knows if he has listened to one of the lectures at the National Gallery or elsewhere. But with the passage of years, several industries (those of textiles, china and earthenware and paper, for example) have long become true repositories of art. We have only to look at the Bayeux tapestry, or a modern dress design, a piece of Royal Worcester or Prince Rupert's head in salt-glaze earthenware, or a good wallpaper, to realize what such art can achieve. The plastics industry has yet to touch its hem.

We know that colour is only one aspect of art, but we stress colour at this point, because it is here in a fairly circumscribed subject, the artist can teach us something, quite irrespective of plastics and of moulding.

We stress it more especially because recently we saw on the market a cup and saucer of "solid" vivid red and others of a strong almost ultramarine blue. Not red or blue decorations on a lighter background, but entirely unrelieved. We have never seen such use of colour in "chinaware" so we can ask whether or not this accords with art. To us they were singularly bad, and we feel sure that the delicate pastel shades which are so readily available to the moulder must be used if we are to attack the "china" market. This is not to say that colour is not appreciated by some moulders. Visitors to the B.I.F. last year will remember the cups, saucers and plates on the stand of British Artid Plastics, Ltd. Without wishing to make invidious distinctions, these objects, moulded from melamine resin and of a translucent pastel blue, compared favourably in texture and colour with anything similar that has been turned out of the Five Towns.

What are the colours we should use and what are the tone limits? We must remember that in plastics, colour decoration against a differently coloured background is so rarely possible that we have seen only one example of it; until this new process is more widely spread, the whole object must be of one colour.

Again, we hope we shall also have, one day, a tinting process for treating finished transparent mouldings in the shop itself. Lovely effects are possible and we shall want to know much about the difference between dyes and pigments and the ways of using them.

In all this the artist must help.

A reader of "Plastics" who is in possession of copies of the journal, 1941 to 1947 inclusive, would like to present them to some school or technical institute free of charge. We shall be pleased to pass on any requests.

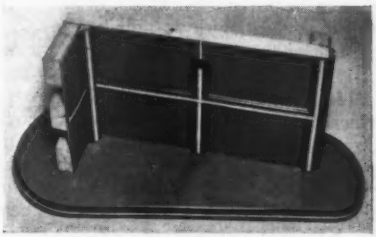
Novel Plastic Covering Strip

ONE of the most gratifying of modern tendencies in the use of the polyvinyl types of plastics is their growing application in the technical world.

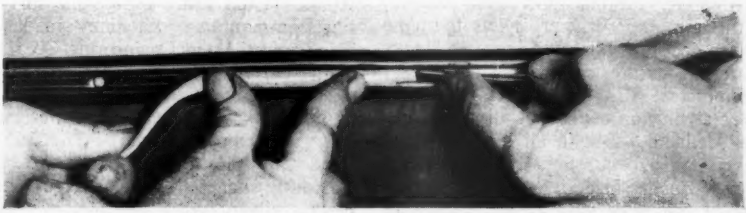
Of these applications, one of the most ingenious and decorative is that recently developed by Melwood Thermoplastics, Ltd., of Luton, the well-known producers of extruded p.v.c. It is in the form of a channelled strip (patent applied for), standard width 1 in., which serves to cover the joins between any type of wall-board, panelling, or similar construction for offices, showrooms, coach bodies, etc., for table and counter edging, furniture decoration, decorative buffer for trolleys and other movable objects. Obviously, too, it can serve as a draught excluder.

The channelled extrusion is fixed by nailing through the groove, this groove then being "filled" by slipping in a secondary insert strip which thus hides the nails and provides a finish (in contrasting colour, if desired). As the strip is flexible it bends easily around a sharp radius. Permanently colourful (10 colours are available), it needs no maintenance, and supplied in rolls there is no waste.

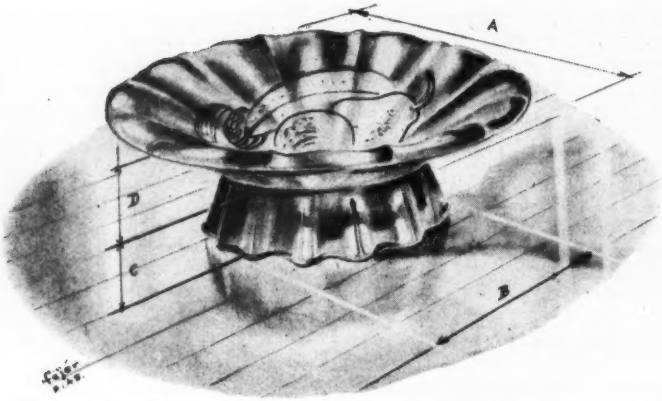
We suggest that this strip should be closely examined also by manufacturers of such metal and wood units as radio cabinets, refrigerators, etc., where the joining of two sheets is both a technical and decorative problem.



Model showing principle of concealing the joints of panelling, and adapted as beading for a curved edge.



The task of inserting the secondary strip in the groove is assisted by any blunt tool, such as a screwdriver.



Design for an Injection Moulded Fruit Bowl

An Interview with the Designer,

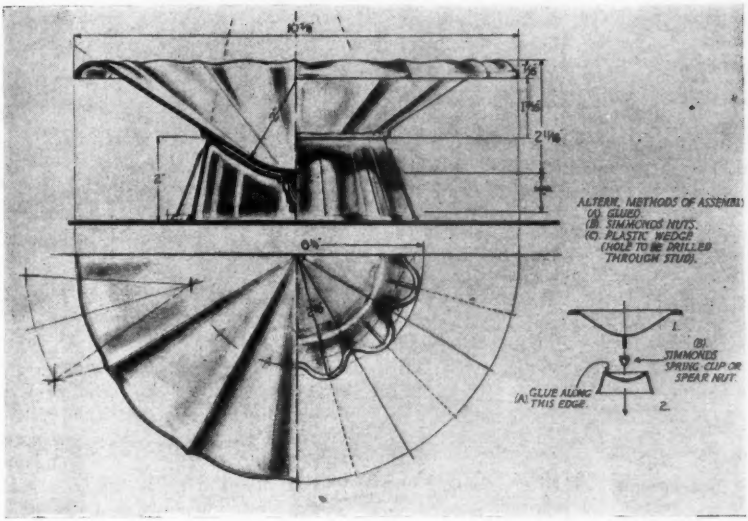
G. FEJÉR, M.S.I.A.

THERE is no better way of judging whether or not an article of utility is well designed than by examining how far the designer has succeeded in meeting various requirements in the problem put to him. In this situation the designer—irrespective of whether he is one recognized as such, or is merely a handyman, should be able to answer the most critical questions from any potential user of the article. Indeed, this airing of views can do both the designer and the user an appreciable amount of good.

Design is a process involving a chain of decisions, and every decision must have some rational and valid reason. Sometimes the designer is left to make all the decisions himself as regards shape, material, texture, colour and method of manufacture. In other cases his job is mere styling on a product already fairly well defined. But in all cases he must have a fairly watertight case, appreciation of quality in design being bound up with a full understanding of the design process.

Feeling that it would serve a distinctly useful purpose to look at some typical plastic production in the presence of the designer responsible for it, we recently interviewed Mr. G. Fejér, M.S.I.A., regarding his own design for the injection-moulded fruit bowl which we illustrate above. We set out below the various questions asked of him and the answers which he gave. The bowl, we may add, has been moulded in cellulose acetate by British Mouldex Rubber Co., Ltd., using one of the injection-moulding machines made by The Projectile and Engineering Co., Ltd., Battersea, London, who also made the necessary tools.

QUESTION: What are the designer's views regarding material? The fact of employing plastics for this fruit bowl obviously suggests that plastics will have certain advantageous features over conventional materials, such as glass or wood.

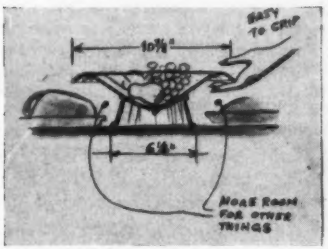


ANSWER: I feel that glass, porcelain, anodized aluminium, etc., are very cold to touch and maybe an organic material is somehow more compatible with the texture and nature of fruit. For instance, a shallow wood tray or a woven basket are, to my mind, much more natural materials for this purpose, because of their kinder "feel."

Thermoplastics, such as cellulose acetate, acetate butyrate, and even polystyrene, have definitely something of this warmer nature. Personally, I have had a grudge against glass fruit bowls ever since I dropped one. Using materials which are normally cold bodies is also likely to bring the disadvantage of condensation from moisture in the air.

QUESTION: What is the use of that "base" which is to be seen under the actual bowl? Is it not rather a waste? It does not seem to serve other than a purely æsthetic purpose.

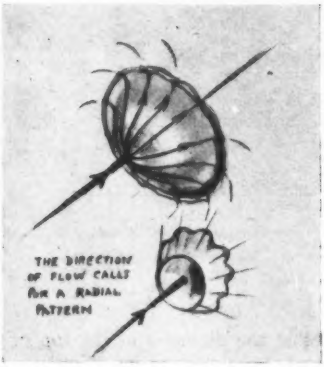
ANSWER: There are two reasons for this "base." First, you will notice that the diameter at the top of the bowl is almost 11 ins. This is rather a large area for any table or sideboard. By "lifting" the bowl the actual area occupied on a crowded table or service trolley is reduced to approximately the same as that taken up by a cup and saucer.



The other reason is a more technical one. Any bowl will need a support of some kind. To have sturdy legs or rings projecting out of the main body would upset the even flow of the injection-moulded material, arrest the texture pattern, and, incidentally, make the moulding

liable to slower cooling, and distortion might be caused by uneven cooling.

QUESTION: Why all these ribs and flutes? Surely the traditional smooth pattern of the Chinese rice bowl, as made and liked for a couple of thousand years, should be good enough.

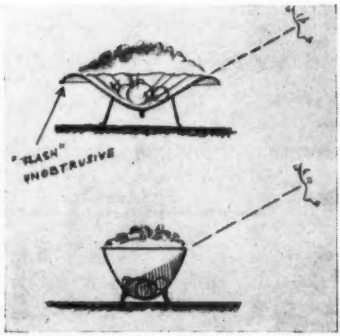


ANSWER: I was aiming at maximum strength and sturdiness within the limits of the given machine, hence the flutes. Whilst the concentric rings of the "thrown" clay give one type of decorative device suitable for the technique, with injection moulding we have a fanwise spread of material, the nature of which almost calls for a petal-shaped pattern.

QUESTION: Regarding the bottom edge of the base, should not this be curved to prevent scratching any polished wood surface upon which the bowl is placed?

ANSWER: Such a curved edge might have introduced complications in moulding and removal of "flash." To my mind, there is little likelihood of scratching, especially when using acetate.

QUESTION: The sides of the bowl are almost straight! Surely, by adopting a curve of bold and deeper section you could accommodate more fruit?

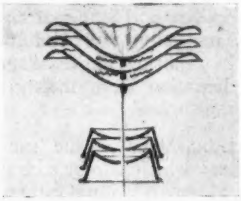


ANSWER: There would also be more fruit "buried" in the bowl which no one could see. I have tried to visualize the article with just a small quantity of fruit in it. The same quantity of fruit would look rather lost and ridiculous in a deeper and truly bowl-like shape.

QUESTION: Have you made half-a-dozen or so prototypes to try out these things? By the way, how many times did the design alter in the course of the work?

ANSWER: There were no prototypes. The sketch design was selected from a set of my suggestions. My blueprint has not been altered in the whole course of pattern making and tool making.

QUESTION: How do these articles "stack" when in stock or when packed for export? Surely this is an unusually difficult shape to stack?



ANSWER: For long-distance transport the two parts are packed separately, to be assembled ultimately by means of a special speed-nut which is pro-

The actual fruit bowl, injection moulded by British Mouldex Rubber Co., Ltd., in translucent and slightly mottled cellulose acetate.

vided. The sprue of the moulding serves as a stud. The two parts stack perfectly well when not assembled; this point was fully considered at the sketch stage.

QUESTION: What about colour? Surely a production such as this would be quite ruined by using inky blues or violent yellows? Do you leave the question of colour to the specialists to decide?

ANSWER: Frankly, I had a particular colour combination in mind when designing this fruit bowl. With the makers' "palette" of compounds we tried out a variety of colours and mixtures. The point is that the choice of colour becomes really a physical question, as each compound has a definite flow-grade and other physical characteristics, and mixing is not as easy as on a palette. The moulders have implemented my own specifications, and produced a wide range of colours.

[EDITOR'S NOTE: Readers will have observed the caption to the above photograph describing the plastic as mottled and, knowing perhaps our dislike of mottling from our animadversions to its use in the industry, may wonder why we have made no comments on it. The reason is that this present colouring is very different from what we have hitherto meant by the word which we have always associated with "solid," that is opaque, and almost invariably highly contrasting colours—and complete absence of form. Mosaic, with its clear definition and pictorial background, we can admire, but not an amorphous higgledy-piggledy, often the result of a desire to use up "left-over" material. Form is one of the outward expressions of beauty, whether in plastic art, painting, music or writing, and we demand it.

We should not, perhaps, use the word mottling for this bowl if mottling means formlessness. Rather is this a veined transparency in which the veins, while being far from regular in pattern, flow from a central point outward to the periphery. They seem to express some of the dynamism of the moulding and impart the impression of "growth" and movement to the whole structure.

Such a pattern can only, we presume, be obtained with a central sprue and it is fascinating, or at least interesting, to conjecture how far it would be possible to control the direction of these veins by using a slightly more flowable plastic, thus intensifying this "growth" and introducing a new, flowerlike design.]

K

The Plastics Industry in India

WE have received from Mr. J. N. Iyer, hon. secretary of the All India Plastics Manufacturers' Association, some interesting details of the progress which was made during 1948. This Association came into existence in 1945, with the object of safeguarding the interests of the new-born plastics industry in India, and now has 60 members embracing all the various aspects.

The rapid increase shown in membership over the brief span of three years is but a pointer to the growth of the industry. Many new factories have come into existence, and the capacity of old ones has expanded.

Notable progress has been witnessed in injection moulding as a specialized branch of the plastics industry. There are about 100 injection machines in India, with an aggregate capacity of about 250 oz. Combs and bangles seem to be the most popular articles, which have found a ready and expanding market.

Some headway has also been made in extrusion. Dominion Plastics Industries, Bombay, have begun the manufacture of knitting pins. Another member firm of the Association, Bright Bros., Bombay, are manufacturing watch straps, although only in limited quantities for the present.

There has been marked improvement in the field of electrical accessories, despite lack of technical aid and non-availability of certain essential raw materials. Among factories devoted to this branch of the industry are Plastic Products, Ltd., Kanpur; Kay Engineering Co., Kapurthala; India Moulding Co., Calcutta; Swadeshi Industries, Calcutta; and Hindustan Plastics, Ltd., Bombay.

The Indian plastics industry is at present largely dependent on foreign countries for its supply of essential raw materials. This anomalous position has been duly recognized by the Indian manufacturers, and considerable progress has already been made in the manufacture of thermosetting moulding powders. Tipco, of Bombay, have been in the market for the past few years; Indian Plastics, Ltd., Bombay, have completed their phase of experimentation, and are shortly to put moulding powder on the market.

With a view to popularizing the aims and objects of the All India Plastics Manufacturers' Association a conference was held at New Delhi in March last. It was stated that the Government had under consideration a proposal to appoint a plastics adviser to render technical advice to the industry. One of the special features of the conference was the display of various types of plastics articles at the All India Plastics Exhibition.

At the half-yearly general meeting of the Association, held in July last, it was unanimously resolved to send a delegation of four plastics manufacturers to the United Kingdom and the U.S.A., with the object of personally inspecting some of the large plastics factories and contacting consulting engineers and chemists, and the hope of evolving suitable policies for the development of the Indian plastics industry on sound lines. The following members were selected to constitute this delegation:—Mr. J. V. Ruia (Hindustan Plastics, Ltd.), Mr. Raj Narain (Indian Plastics, Ltd.), Mr. B. M. Thakkar (Tipco, Industrial Plastics Corporation), Mr. B. A. Shah (Collins and Co.), all of Bombay.

A comprehensive report of the work done by this delegation will be made available in due course.

Due recognition has been afforded by the Government of India to the important rôle the plastics industry is going to play in the economic reconstruction of the country. The Government have set up a Panel covering the plastics and celluloid industries, and charged with the function of reviewing progress, and making suitable recommendations for expansion during the next five years.

A New Laminate for Merchandise Crates

THE shortage of plywood and similar packaging materials for crating purposes has prompted British Celanese, Ltd., to investigate the possibilities of finding a suitable alternative.

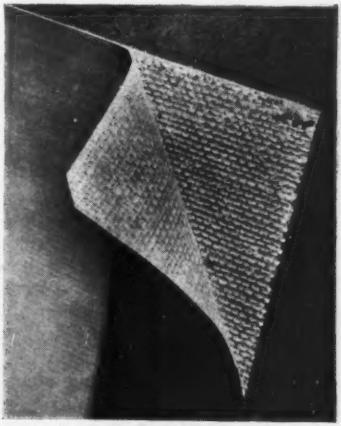
To dispense with any form of wood was the prime objective, and the idea was formulated of laminating "Celastoid" sheeting with other bonding materials. This idea was put to the test, and the outcome of many months of experiment and enterprise led to the development of laminating the sheeting with hessian—the latter being a commodity which, although in short supply, is nevertheless available to a degree, is reasonably cheap, and has, of its own accord, considerable strength. This laminate is now being produced by British Celanese, but so far their own requirements have absorbed the entire production.

The laminate produced at present consists of three layers of "Celastoid" sheeting and two layers of hessian, the hessian being sandwiched between the central and outer layers of sheeting by means of heat and pressure. Using "Celastoid" sheeting of 20 thou. thickness, the resultant thickness of the laminate is approximately 70 thou., or somewhat less than 1/10 in.

The combination of the properties of these two materials has resulted in an exceptionally fine alternative to plywood, but in very many respects it is infinitely better. In short, "Celastoid" sheeting/hessian laminate has everything that plywood has, and then a lot more. It is very strong, having high impact and tensile strengths; is light in weight; will

(*Continued on page 35.*)

(Left) Typical crate, utilizing "Celastoid" and hessian laminate, as employed by British Celanese, Ltd., for transport of their own textile products.



(Above) The new laminate partly dissected to show one of the internal layers of hessian.

World's Industry Employs Plastics

GENERAL ENGINEERING

Vibration and shock.—C. J. Bastien summarizes application data on mounting materials for machinery, including rubber, cork and felt, and lists the sizes and properties of a large number of commercial types. ("Product Engineering," 1948/Oct./112.)

Metal-to-metal bond.—A new adhesive for metal-to-metal bonding (Minnesota Mining and Manufacturing Co., 900, Tanquier Avenue, St. Paul, Minn.) is in the form of a transparent film. It is 100 per cent. adhesive, with no supporting material in the film. The film is placed between the surfaces and cured by heat and pressure, temperatures of 30 to 500 degress F. for 5 to 60 min., and a pressure of 25 to 100 lb./sq. in. being employed. ("Materials and Methods," 1948/Sept./152.)

Welding of thermoplastics.—The special composition of thermoplastics suitable for welding, as well as the various welding methods, are discussed in "Techn. Rundschau," Bern., 1948, No. 41/9 and No. 42/17. Hot-gas welding, contact heat welding with heated tools, high-frequency welding (spot welding, continuous seam welding, pressure welding), and friction welding are mentioned.

Glass-reinforced plastics.—Recommendation for the correct design of glass-reinforced plastic parts are given by R. White. In the Jack and Heintz auxiliary aircraft power unit the polyester laminate, "Glastic," is used for five air-duct parts. This material replaces, in particular, complicated sheet-metal parts. Production technique is also reviewed ("Machine Design, 1948/Oct./103.)

Laminate bearings.—The special advantages of laminate bearings are stressed, and design data has been compiled, also for rubber bearings. ("Product Engineering," 1948/Oct./148.)

Silicone rubber.—The physical, chemical and electrical properties of silicone rubber have been investigated from the point of the design engineer. (Transactions A.S.M.E., 1948 / Oct. / 831: abstracted in "Mechanical Engineering," 1948/Nov./918.)

Sealing compounds.—American Latex Products Corp., 921, Venice Blod, Los Angeles 15, California, announces two improved thermal barrier materials withstanding temperatures up to 2,800 degrees F. They are obtainable in various consistencies for application by trowel, brush or gun. Apart from electrical applications, they are said to be useful for lagging steam pipes and hot-air ducts. The materials are basically of plastic nature, and cure by solvent release at about 80 degrees F., to form a hard, but not inflexible, sheath. ("Machine Tool and Blue Book," 1948/October/251.)

Hardness of wood.—R. C. Weatherwax, E. C. O. Erickson, A. J. Stamm have developed a modified ASTM hardness test for woods ranging in specific gravity from 0.07 (Balsa wood) to 1.4 (Compreg or Staypak). Tests were made under increasing loads in an hydraulic testing machine (load was applied at uniform rate of 0.02 in./min. Measurements of depth to 0.001 in. load against penetration or surface of contact gives a linear relationship over major part of test range; the slope is called hardness modulus. (A.S.T.M. Bulletin, 1948/Aug./84.)

AIRCRAFT

Aircraft propellers. — V. Rose describes a new technique of forming and joining sheet-metal pressed aircraft propellers, the hollow space within being filled with a rubber compound, thus producing a strong propeller of notably light weight. ("Materials and Methods," 1948/Sept./66.)

Aircraft plywood.—Technical investigations of a special plywood for experimental aircraft have been published by H. Brunner. The plywood consists of four layers of beechwood with Tegofilm as glue. The two outer layers, 0.37 mm. thickness, each have parallel fibres, whereas those of the internal layers, 0.73 mm. thickness, are crossed at 90 degrees and run at 45 degrees to the outer layers. Data on tensile and bending strength are given. ("Schweiz. Archiv fuer angew. Wiss and Technik," 1948/June/181.)

CHEMICAL

Non-corrosive thermoplastic. — Combination of synthetic rubber of the acrylonitrile group with a synthetic resin called "Versalite" gives a non-corrosive, though easy-to-form material, which is stable up to 220 degrees F. ("Product Engineering," 1948/Oct./176.)

Vinyl plasticizer.—A new phosphate-type material has been developed by Monsanto Chemical Co., St. Louis, 4, Mo., as primary plasticizer for polyvinyl chloride and polyvinyl acetate film, or moulded articles. It gives good low temperature flexibility. ("Materials and Methods," 1948/Sept./150.)

Structure of polymers.—C. W. Bunn gives an interesting survey on the molecular structure and physical properties of high polymers. Differences between chemically different polymers are explained in a qualitative way by the structure and arrangement of high polymer molecules. Lines of future progress are outlined. ("Research," 1948/Nov./630.)

Visco-elastic properties.—In a concentrated polymer solution the entanglement of long chain molecules results in a transient network structure, to which may be attributed certain aspects of the visco-elastic behaviour of such a system. With a solution of polystyrene in xylene, for example, the elastic energy may be stored in the network strands by twist against the potential, hindering free rotation about bonds in the chain. ("Journ. Res. Nat. Bur. Stand.," 1948/July/53.)

MISCELLANEOUS

Non-skid tyre.—Various substances, including cork, steel coils, abrasives and sawdust, have been tried to give rubber compounds resistance against skidding. The newest idea, by U.S. Rubber Co., Rockefeller Centre, New York, N.Y., is to compound rubber with ordinary rock-salt. When the tread wears, the salt pieces drop out, leaving small surface pits which grip the ice. On clear lake ice the new treads stop cars up to 30 per cent. more quickly. ("Business Week," 1948/Sept. 4/60.)

Textile machinery.—Part of the flyer in textile machinery employed to guide the yarn and keep it under tension will work at speeds up to 15,000 r.p.m., without lubrication, when made of nylon. The oiling of conventional flyer blocks sometime spoils the yarn. The nylon flyer is produced by M. J. McHale Co., Scranton, Pa. ("Business Week," 1948/Sept. 4/62.)

Insulating materials.—Ch. Caflisch deals with two important material problems of the insulating technique, sensitivity to moisture and heat limit; silicone lacquers, in particular, are considered. The physical properties are determined by simple testing arrangements. ("Bull. Schweiz. elektrotechnis cher Vereine," 1948/39/399, abstracted in "Kunststoffe," 1948/Oct./201.)

Lighting fixtures.—In a paper presented to the Society of the Plastics Industry, U.S.A., F. W. Tetzlaff reviews the application of acrylic sheet materials for lighting fixtures. Experiments with electric street lamps indicate that the acrylics can be used with lamps up to 6,000 lumen if the ventilation and design is proper. ("Product Engineering," 1948/Oct./122.)

Plating equipment.—Applications of thermoplastic materials, especially polythene, in metal finishing plant, and accessories, are examined in the light of modern plastic welding methods. ("Electroplating," 1948/Nov./700.)

Barrel tumbling. — The technique applied to the cleaning and polishing of small plastic components by barrel tumbling is described by H. A. Knight. ("Materials and Methods," 1948/Sept. 83.)

Protective coating.—A general article outlines the importance of alkyd resins for metal finishing, and indicates some future advances, such as wider use of highly polyhydric alcohols, use of polybasic acids other than phthalic, modification of alkyd resins with difunctional reagents, reacting at room temperatures. ("Products Finishing," 1948/Aug./80.)

Dry grinding belt, which is also heat-resistant, uses a special thermosetting resin instead of conventional glue-type adhesives. These belts, by Behr-Manning Co., Troy, N.Y., will longer remain sharp, and substantial production increases are claimed. ("Products Finishing," 1948/Oct./119.)

Moulding.—Tablet presses, injection moulding, and extrusion for thermoplastic and thermosetting resins, are discussed in "La Machine Moderne." (1948/Sept./6.)

Abrasive belt.—Extra durability and heat resistance is claimed for an abrasive cloth belt (Minnesota Mining and Mfg. Co., St. Paul 6, Minn.) provided with aluminium oxide grain (24 to 120 mesh), coated on a flexible cloth backing with resin bond. ("Products Finishing," 1948/Oct./124.)

Transparent coating.—A self-contained compact sprayer has been developed for a new plastic spraying material, "Krylon" (Foster and Kester Co., Philadelphia 32, Pa.). The coating dries in less than 1 minute. It can be removed by a special solvent. ("Machine Tool and Blue Book," 1948/Oct./309.)

Laminates.—A short survey of manufacturing methods for decorative laminates, as also for engraving and printing, is given by Ch. R. St. Quintin. ("Science and Engineering," 1948/Aug./31.)

Polishing.—For polishing polymethyl methacrylate, it is recommended to use fine Tripoli powder, followed by a good finishing composition. ("Practical Engineering," 1948/Nov. 12/484.)

Vinyl latices.—J. L. Foster deals with application of unplasticized vinyl latices as versatile coating. String fibres of many types can be formed by water dispersion of synthetics without special equipment and solvents. ("Materials and Methods," 1948/Oct./81.)

Mould design.—An elementary introduction into the intricacies of moulds for thermosetting materials is given by P. O. Campo. ("La Machine Moderne," 1948/Oct./1.)

Vacuum cleaners.—Views and sections of the many plastic components of the new Hoover Junior vacuum cleaner are given in "Product Engineering," 1948/Oct./94.

Silicones.—W. K. Given, in a paper read to A.S.M.E., foresees many more products to be developed from silicones. A sample of silicone-rubber baked for 36 hrs. at 300 degrees F. was still resilient. "Bouncing putty" silicone-rubber is used for the centres of golf balls and as a device for levelling tables and chairs. ("Chemical Age," 1948/**59**/619.)

Cellulose Acetate Plastics

XVII.—Flow Properties

By
Vivian Stannett
and R. Whitfield

THE economic success of cellulose acetate plastics is closely associated with the development of the injection moulding process which revolutionized fabrication techniques and usurped almost completely the older compression moulding methods. The excellent flow characteristics of this material make it ideally suitable for injecting moulding as these properties can be varied to suit the needs of the commercial moulder. The immense popularity of cellulose acetate as a material for injection moulding can, therefore, be easily understood.

Moulding powders are often divided empirically into several grades of hardness, and for most purposes this is quite satisfactory as the moulder knows from experience the best operating conditions for each grade. The choice of the correct grade is obviously of great importance, as on this the efficiency and speed of production, as well as the quality of the finished moulding, depends. Where mechanical strength is of secondary importance, as with brooches, for instance, and other simple articles, soft-grade material is usually preferred, since this flows more readily and a high rate of production is possible. In other cases, where the moulding is required to withstand mechanical stresses or abnormal conditions of temperature and humidity, a harder grade will usually be required, which may necessitate a reduction in production rate. From the standpoint of the moulding powder manufacturer, careful control of flow properties is essential to ensure uniformity within each grade, and with this object in view a number of criteria have been suggested for the specification of flow properties.

Flow Temperature

The wide variation in the design and construction of injection machines makes it quite impracticable for the moulding powder manufacturer to specify his products according to the temperature at which they should be injection moulded. Any attempt to do so would most probably result in a state of chaos within the industry. It is quite feasible, however, to quote a temperature at which the material has defined flow characteristics under carefully specified conditions of test. This is the procedure usually adopted and although the results are relative only, they afford valuable comparative information.

Measurement of Flow Temperature

Perhaps the best-known apparatus used for the measurement of flow temperatures is the Rossi-Peakes extrusion-type plastometer.[1] With this apparatus the rate of extrusion of a preform into an orifice of standard dimensions under a constant pressure is measured. By repeating the tests at a number of different temperatures, the temperature at which the material extrudes at a specified rate may be determined. In practice, a preform $\frac{3}{8}$ in. long and $\frac{3}{8}$ in. in diameter is used, and the orifice is $1\frac{1}{4}$ ins. long and $\frac{1}{8}$ in. in diameter. The temperature at which the material flows 1 in. in a period of 2 minutes, through this orifice, is taken as the "flow temperature."

The modified Dillon plastometer[2] operates on a similar principle, but differs in constructional details and requires a larger charge of material. The rate of extrusion through an orifice $\frac{1}{16}$ in. diameter under a pressure of 3,025 lb. per sq. in. is measured over a range of temperatures. The temperature at which the extrusion rate is 10 c.c. per minute is determined graphically and is taken as the flow temperature.

An entirely different type of instrument which has been used for the measurement of "relative plasticity" is the Mooney shearing disc plastometer.[3] This measures the shearing viscosity of the plastic, in terms of the torque produced when a corrugated disc is rotated at a constant speed in the plastic, which is enclosed within a special mould. By carrying out the experiment at a number of temperatures, the temperature at which the material has a definite shearing viscosity may be determined.

Other types of apparatus are the parallel plate plastometer [4] and the multi-capillarity die.[5] The latter is interesting as it attempts to imitate more closely actual moulding conditions by measuring the rate of extrusion of the moulding powder into a number of capillaries of varying diameters, from which an overall plasticity index is calculated. The temperature at which the material has a specified index is taken as the flow temperature. Results obtained with this die for a number of thermoplastic materials are illustrated graphically in Fig. 1; those obtained with the other types of plastometers are given in Table 1.

Examination of Table 1 shows that the flow temperature for the same material varies with the method of test, and consequently this must always be carefully specified, otherwise the results are meaningless. However, L. W. A. Meyer[6] showed that the results obtained by the Rossi-Peakes method may be correlated fairly accurately with those obtained by the Dillon extrusion plastometer or the Mooney shearing disc instrument, for a given plastic. This is illustrated graphically in Figs. 2 and 3. It is interesting to note that the Dillon extrusion plastometer gives the highest flow temperatures, but even these values are considerably below practical injection moulding temperatures. The wide range of flow temperatures covered by cellulose acetate formulations is well illustrated by Table 1, as is also the low flow temperature of vinyl co-polymers and the high flow temperatures of acrylate plastics.

Flow Temperature and Raw Flake

In a previous article of this series[7] it was shown that the flow temperature of cellulose acetate plastics increases with the acetic acid content or degree of esterification of the raw flake. It was also shown how the viscosity or degree of polymerization of the raw material affects flow temperature. These are fundamental properties of the raw flake, and although they are of great importance in relation to the physical properties of the finished moulding, they are not very amenable to adjustment. The most easily controlled variables are the nature and quantity of the plasticizers used in the formulation, and by suitable modifications a range of moulding powders may be prepared from the same base material.

Flow Temperature and Plasticizers

The individual and combined effects of a number of commonly used plasticizers on the flow properties of medium and high acetyl value flake material are shown in Tables 2 and 3, taken from the work of W. E. Gloor,[8] and are demonstrated graphically in Figs. 4 and 5. The effects of the plasticizers on the mechanical properties are also included, as these are important considerations in the choice of moulding powders. It will be seen that low flow temperature formulations are obtained with ortho- and para- toluene sulphonamide and high ones with triphenyl phosphate. The relatively small influence of triphenyl phosphate is indicated by the low slope of the line corresponding to this plasticizer in Fig. 4.

Although a low flow temperature is advantageous from the standpoint of the injection process, it often affects adversely the mechanical properties of the finished moulding. By increasing the flow temperature, the hardness, tensile and flexural strengths, and the modulus of elasticity, are all increased. The dimensional stability and heat distortion temperature are also improved.

The linear relationship between flow temperature and plasticizer content sug-

Table 1.—Variation of the Flow Temperature with Method of Test for a number of Thermoplastics. (Meyer[6])

Type and Designation	Rossi-Peakes Flow Tester. Flow Temperature °C	Mooney Shearing Disc Plastometer. Relative Plasticity °C	Modified Dillon Extrusion Plastometer. Extrusion Temperature °C	Modified Williams Parallel Plate Plastometer. Plastic Temperature °C
Methacrylate—				
1	169.6 a	182.0	—	—
2	156.1 a	169.0	—	—
3	153.9 a	173.0	—	—
4	146.4 a	160.5	—	—
Polystyrene—				
5	135.9 a	129.3	172.0	177.0
6	125.1 a	121.3	154.3	145.6
7	112.5 a	112.5	146.6	142.7
Vinyl Co-polymer—				
8	128.1 b	141.0	158.7	170.0
9	120.4 b	130.0	145.6	162.5
10	119.2 b	124.0	141.4	149.5
11	118.5 b	122.0	135.5	157.3
12	107.5 b	111.5	129.8	134.9
13	104.0 b	112.0	128.4	133.3
14	99.6 b	106.0	122.4	144.7
Cellulose Ether—				
15	138.4 b	135.1	157.2	—
16	131.3 b	123.9	155.7	—
17	128.2 b	122.2	159.3	—
Cellulose Acetate—				
18	151.7	155.0	178.3	—
19	150.8 c	150.6	179.4	153.5
20	148.3 c	149.0	174.0	165.7
21	140.8 c	141.1	166.7	144.6
22	140.5 c	143.3	166.9	150.5
23	133.9	141.5	160.8	148.7
24	136.7 c	141.7	164.9	141.8
25	134.8 c	139.4	161.3	148.7
26	131.3 c	132.2	159.4	144.8
27	126.7	129.0	—	100.1
28	124.6	127.0	162.8	153.8
29	123.9	126.0	155.8	171.0

(a) Average of results from two machines.
(b) Average of results from three machines.
(c) Average of results from four machines.

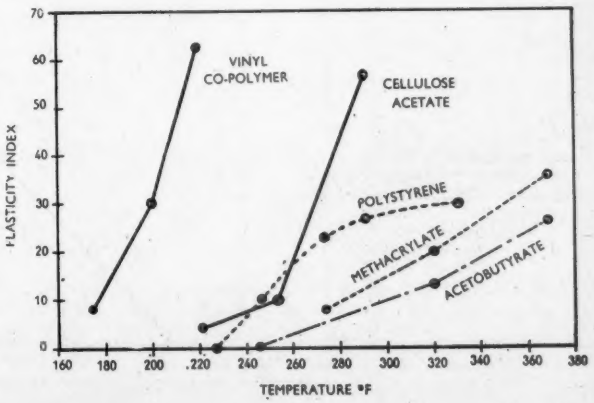


Fig. 1.—Plasticity index curves for various thermoplastics, as determined by the multi - capillarity die. (Burns.)

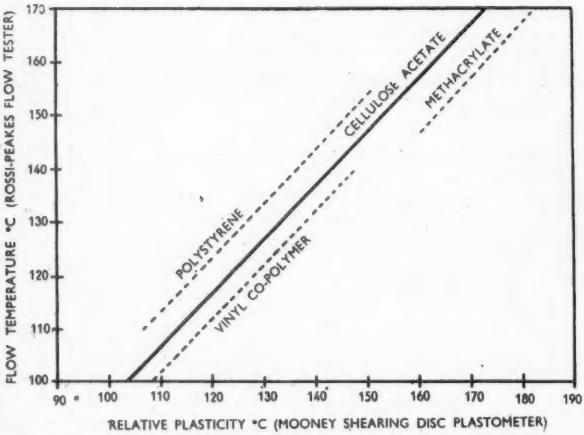


Fig. 2—Correlation curves for various thermoplastics as determined by Rossi-Peakes - Mooney methods[1] (Meyer[6]).

gests that the flow temperatures of formulations containing mixed plasticizers might be predicted by simple proportion from the specific effect of each. This was shown by W. E. Gloor to be possible with a fair degree of accuracy for a number of formulations. The mechanical properties did not appear to be capable of satisfactory prediction on these lines, and no definite relationship between flow temperature and mechanical properties at room temperature was established. The results obtained by Gloor in both these connections are summarized in Tables 4 and 5.

Rate of Flow

The flow characteristics of cellulose acetate have been considered from the standpoint of flow temperature, but this is not completely satisfactory as it only supplies information on the flow properties under one particular set of experimental conditions. To gain a more complete picture it is necessary to study the rate of flow over a range of tem-

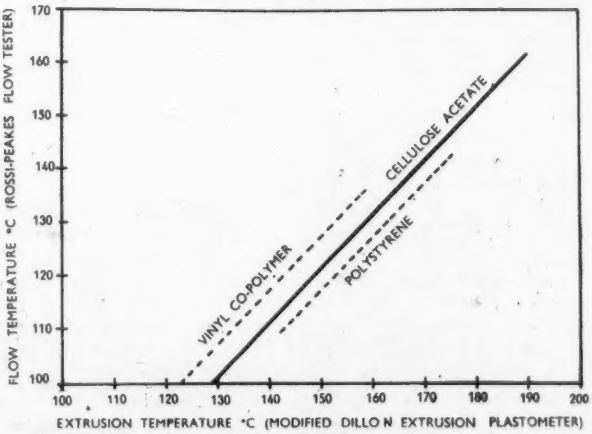


Fig. 3—Correlation curves for various thermoplastics, by Rossi - Peakes - Dillon methods (Meyer[6]).

Table 2.—Composition and Physical Properties: Cellulose Acetate Plastics[8] (single plasticizer).

% Composition			Rossi-Peakes flow temperature °F	Rockwell hardness	Charpy impact strength ft. lb./sq. in.	Elastic modulus lb./sq. in.	% Water absorption (96 hours)
Cellulose acetate	Single plasticizer						
72	28	Dimethyl-phthalate	282 a	64 a	3.4 a	524,000 a	1.9 a
			297 b	54 b	1.7 b	423,000 b	1.3 b
69	31		266 a	52 a	4.0 a	468,000 a	1.7 a
			272 b	40 b	2.8 b	343,000 b	1.1 b
66	34		252 a	41 a	4.7 a	364,000 a	1.5 a
			255 b	13 b	4.1 b	267,000 b	1.0 b
72	28	Diethyl-phthalate	310 a	60 a	4.2 a	350,000 a	2.2 a
			307 b	40 b	1.9 b	271,000 b	1.4 b
69	31		300 a	49 a	4.8 a	242,300 a	2.0 a
			293 b	24 b	2.5 b	215,000 b	1.3 b
66	34		285 a	36 a	5.9 a	236,000 a	2.0 a
			273 b	2 b	3.1 b	199,000 b	1.0 b
72	28	Triphenyl phosphate	343 a	80 a	1.8 a	320,000 a	2.0 a
			355 b	61 b	1.0 b	327,000 b	1.5 b
69	31		340 a	75 a	2.1 a	260,000 a	1.9 a
			342 b	53 b	1.3 b	276,000 b	1.5 b
66	34		333 a	68 a	3.9 a	235,000 a	2.2 a
			331 b	34 b	1.2 b	237,000 b	1.5 b
72	28	Methyl phthalyl ethyl glycolate	313 a	88 a	1.4 a	399,000 a	1.6 a
			320 b	69 b	1.1 b	350,000 b	1.1 b
69	31		302 a	82 a	1.7 a	360,000 a	1.5 a
			304 b	63 b	0.8 b	288,000 b	1.0 b
66	34		291 a	74 a	2.8 a	311,000 a	1.4 a
			284 b	57 b	0.6 b	215,000 b	0.9 b
63	37		278 a	60 a	3.3 a	257,000 a	1.3 a
			— b	— b	— b	— b	— b
72	28	o- and p-toluene sulphonamide	229 a	90 a	2.4 a	708,000 a	1.7 a
			280 b	94 b	0.7 b	486,000 b	1.1 b
69	31		212 a	88 a	2.1 a	653,000 a	1.4 a
			255 b	83 b	0.7 b	480,000 b	1.1 b
66	34		201 a	91 a	1.4 a	552,000 a	1.2 a
			235 b	81 b	0.7 b	454,000 b	0.8 b

(a) 53.0% combined acetic acid; 0.7 free OH per C_6 (b) 57.2% combined acetic acid; 0.4 free OH per C_6

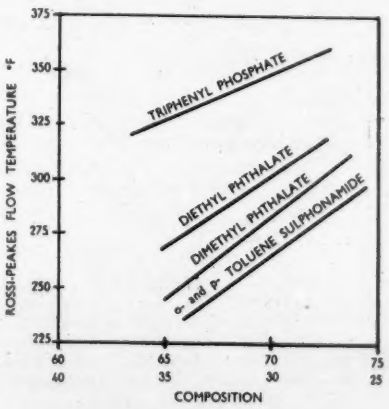


Fig. 4.—Effect of plasticizers on flow temperature of cellulose acetate plastics, 53.0 per cent. combined acetic acid content. (Constructed from results of Gloor[8].)

Table 3.—Composition and Physical Properties: Cellulose Acetate Plastics[8] (mixed plasticizers).

% Composition		Rossi-Peakes flow temperature °F	Rockwell hardness	Charpy impact strength ft. lb./sq. in.	Elastic modulus lb./sq. in.	% Water absorption (96 hours)
Cellulose acetate	Mixed plasticizer					
72	18.7 Dimethyl-phthalate	322 a	68 a	3.4 a	318,000 a	1.9 a
	9.3 Triphenyl-phosphate	320 b	52 b	1.6 b	284,000 b	1.4 b
66	22.7 Dimethyl-phthalate	300 a	54 a	4.3 a	254,000 a	1.8 a
	11.3 Triphenyl-phosphate	284 b	15 b	1.9 b	202,000 b	1.0 b
72	9.33 Dimethyl-phthalate	319 a	88 a	1.9 a	398,000 a	1.6 a
	9.33 Santicizer M-17	325 b	67 b	1.1 b	353,000 b	1.2 b
	9.33 Triphenyl-phosphate	—	—	—	—	—
66	11.33 Dimethyl-phthalate	297 a	72 a	2.6 a	293,000 a	1.4 a
	11.33 Santicizer M-17	288 b	30 b	1.0 b	217,000 b	1.0 b
	11.33 Triphenyl-phosphate	—	—	—	—	—

(a) 53.0% combined acetic acid; 0.7 free OH per C_6 (b) 57.2% combined acetic acid; 0.4 free OH per C_6

peratures and pressures. This can be done conveniently in the same type of apparatus as is used for the determination of flow temperatures, providing that the temperature and pressure can be adjusted and controlled accurately.

The variation of the rate of flow with temperature when the pressure is kept constant is illustrated in Fig. 6. The rapidly increasing slope of this curve shows that temperature exerts a marked affect, and, under certain conditions, an increase of 10 degrees C. may result in a double, treble, or even greater increase in the rate of flow. For many formulations tested on an extrusion-type plastometer, it is found that over a limited range the logarithm of the rate of flow is directly proportional to the temperature, so that the results may be expressed by the simple equation: $\text{Log } R = nT + C$, where n and C are constants. This statement is in agreement with A.S.T.M. D.569-44T, and with the author's own experiences. However, as Fig. 10 shows, some workers have found that a more linear relationship is obtained by plotting log rate of flow versus the reciprocal temperature.

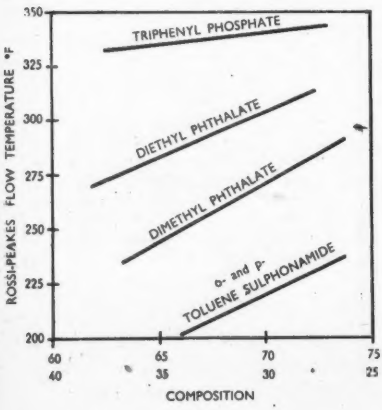


Fig. 5.—Effect of plasticizers on flow temperature of cellulose acetate plastics, 57.2 per cent. combined acetic acid content. (Constructed from results of Gloor[8].)

Table 4.—Predicted versus Measured Values of Physical Properties.[8] Cellulose Acetate (53.1% combined acetic acid) and plasticizer (⅔ Dimethylphthalate and ⅓ Triphenylphosphate).

Formula	Rossi-Peakes flow temperature °F	Rockwell hardness	Charpy Impact strength ft. lb./sq. in.	Elastic modulus lb./sq. in.	% Water absorption (96 hours)
(I) 72% Cellulose acetate 28% Plasticizer (II) 66% Cellulose acetate 34% Plasticizer					
(I) Observed	332	68	3.4	318,000	1.9
Calculated					
D.M.P.	188	42.6	2.2	352,000	1.2
T.P.P.	114	26.7	0.6	106,000	0.7
Predicted (sum)	302	69.3	3.8	458,000	1.9
% Difference	7	2.1	11	50	0
(II) Observed	300	54	4.3	254,000	1.8
Calculated					
D.M P.	168	28	3.2	242,000	1.0
T.P.P.	111	23	1.3	78,300	0.7
Predicted (sum)	279	51	4.5	320,000	1.7
% Difference	7	6	5	24	6

Table 5.—Predicted versus Measured Values of Physical Properties. Cellulose Acetate (53.1% combined acetic acid) and plasticizer (⅓ Dimethylphthalate, ⅓ Methylphthalyl ethyl glycolate (Santicizer M-17), ⅓ Triphenylphosphate).

Formula	Rossi-Peakes flow temperature °F	Rockwell hardness	Charpy impact strength ft. lb./sq. in.	Elastic modulus lb./sq. in.	% Water Absorption (96 hours)
(III) 66% Cellulose acetate 34% Plasticizer					
(III) Observed	297	72	2.6	293,000	1.4
Calculated					
D.M.P.	84	13.7	1.6	121,000	0.5
Santicizer M-17	97	25	0.9	104,000	0.5
T.P.P.	111	13	1.3	78,000	0.7
Predicted (sum)	292	51.7	3.8	303,000	1.7
% Difference	2.5	28	47	5	22

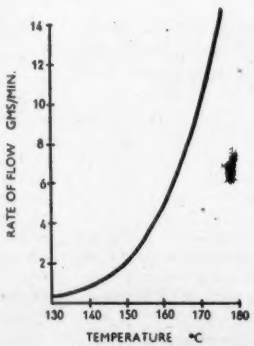


Fig. 6 (left).—Typical curve for variation of rate of flow with temperature for cellulose acetate plastics.

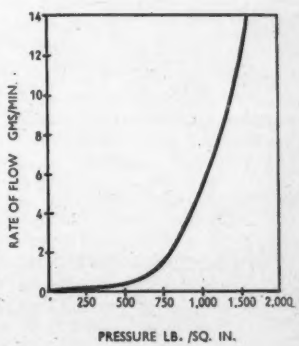


Fig. 7 (right).—Typical curve for variation of rate of flow with pressure for cellulose acetate plastics.

Similarly, by keeping the temperature constant, the variation of rate of flow with pressure may be studied. The general nature of the results is illustrated graphically in Figs. 7 and 8. Pressure is found to be very critical, and under certain conditions a 10 per cent. increase may result in a 100 per cent. increase in extrusion rate. Over limited ranges, a plot of the logarithm of the rate of flow against pressure yields a straight line graph (Fig. 3), and in this connection it is interesting to note that variation in total plasticizer content does not appreciably alter the slope, but only the position of the line relative to the origin.

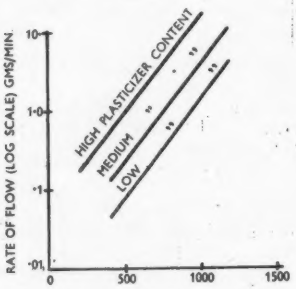


Fig. 8.—Relationship of log rate of flow with pressure for cellulose acetate plastics of varying plasticizer content.

As the rate of flow depends on both temperature and pressure, a complete representation of the characteristics requires a three-dimensional model, Fig. 9. The ordinary two - dimensional graphs obtained by keeping one of the variables constant are simply sections from this solid model.

From the preceding discussion, it will be appreciated that the flow properties of

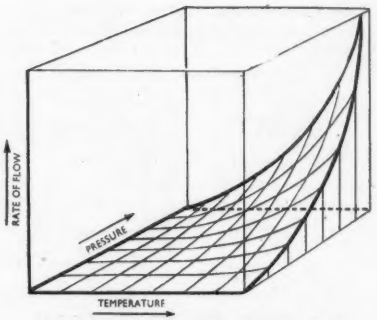


Fig. 9.—Three-dimensional representation of flow characteristics.

cellulose acetate, even on a relatively simple laboratory extrusion apparatus, are extremely complex, and the large variation in flow which may result from small changes in temperature or pressure emphasize the need for the careful control of these factors. However, in an actual injection machine the conditions are far more complex, as the mould is usually complicated in design and the material is cooling continuously as filling proceeds. Consequently, the time cycle has to be determined by purely empirical methods for each individual mould and set of conditions.

Mechanism of Flow

The flow properties of cellulose acetate can be considered as the resultant of a number of individual effects depending on the elastic and viscous charac-

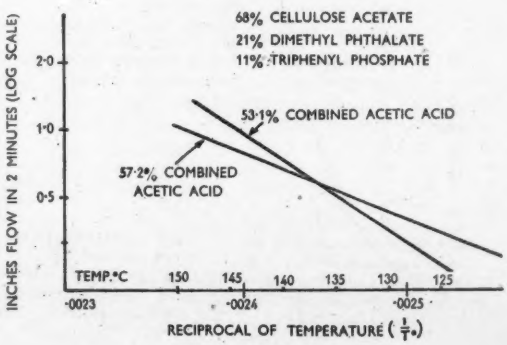


Fig. 10.—Flow temperature relationship for cellulose acetate, using Peakes-Olsen flow tester. (Gloor[8].)

teristics of the material. At room temperatures, the elastic properties are predominant, as may be illustrated very simply by flexing a comb or other similar object moulded from cellulose acetate. Viscous properties are not entirely absent, however, as distinct "creep" effects are observed when the material is subjected to constant loads for prolonged periods of time. With increase of temperature, the elastic properties diminish and the fluid nature becomes more definite, until eventually the elastic properties disappear almost completely.

The quantitative theoretical development of such a complex system is extremely complicated, but important advances have been made, notably by Turner Alfrey,[9] who stresses the importance of approaching the problem by analogy with mechanical models. For instance, the behaviour of a material exhibiting flow superimposed on elasticity may be represented by a spring fixed at one end and attached to a dash pot at the other. The spring represents the elasticity and the dash pot the flow or viscous properties of the material. The mechanics of a system such as this can be worked out readily, and the behaviour of the material deduced by analogy. By elaboration of this method, extremely complicated systems can be analysed and treated in a quantitative manner.

(To be continued.)

Corrections

The following corrections have to be made in the instalment of "Cellulose Acetate Plastics" published in "Plastics" for October, 1948.

Page 530, right-hand column, line 5: For "diethyl phthalate" read "dimethyl phthalate."

Page 535, right-hand column, line 16: For "Findley's work showed that cellulose acetate mouldings undergo considerable periods of time" read "Findley's work showed that cellulose acetate mouldings undergo considerable deformation when subjected to relatively small loads for prolonged periods of time."

REFERENCES

(1) *U.S. Pat.* 2,066,016, *L. M. Rossi and G. L. Peakes.* (2) *J. H. Dillon,* "*J. Applied Physics,*" 1936/7/73. (3) *Melvin Mooney,* "*Ind. Eng. Chem., Anal. Ed.*, 1934/6/147. (4) *Ira Williams,* "*Ind. Eng. Chem.,*" 1924/16/352. (5) *R. Burns,* "*Proc. A.S.T.M.,*" 1940/40/1283. (6) *L. W. A. Meyer,* "*A.S.T.M. Bulletin,*" *August*, 1940, *page* 23. (7) *Plastics*, 1947/11/526. (8) *W. E. Gloor,* "*J. Applied Physics,*" 1941/12/420. (9) *Turner Alfrey,* "*Mechanical Behaviour of High Polymers,*" (*Interscience Publishers Inc.*). (10) *C. J. Frosch,* "*Bell Laboratories Record,*" *Feb.*, 1944.

PLASTICS IN SOUTH AFRICA

THE Board of Trade and Industries, South Africa, reports that application has been made by a manufacturer of plastic goods for a rebate of duty on "raw castings" used in the production of plastic goods. The castings are made from thermosetting and thermoplastic resins, and include backs and handles for brushes. The manufacture of these castings from specialized basic materials is undertaken by only a few large overseas manufacturers. Technical advice obtained by the Board indicates that thermosetting and thermoplastic resins suitable for castings could not be imported because they must be used within a few months of manufacture. Further, manufacture of these resins in the Union is considered unlikely in the immediate future. Even were it possible to obtain supplies of basic raw materials for the purpose of making these castings, it might prove uneconomic on account of the cost of making a wide range of moulds and dies. The manufacture of plastic goods in the Union has developed appreciably in recent years and the industry has already received a measure of assistance in the form of a rebate of the duty on certain raw materials. These materials, however, are not of the type used in making the castings which are in request. The raw castings are at present dutiable at 10 per cent. ad valorem under Tariff item No. 335 and in these circumstances the applicants are unable to compete with overseas manufacturers of plastic goods. Furthering development and expansion of the industry, the Board, therefore, feels that the admission of raw castings under rebate of duty should be granted, and has recommended that "Raw castings (i.e., castings straight from the lead mould without any further processing) made from thermosetting or thermoplastic resins," be admitted under a rebate of the whole duty at present imposed.

Applications of the Plastic Replica Process to Surface Finish Measurement

By C. TIMMS, M.Eng., A.M.I.Mech.E., A.M.I.P.E., and C. A. SCOLES

The authors here describe the use of plastic impressions for measuring the degree of surface finish of large engineering components, such as marine gear teeth and the flanks of master lead-screws, which are not readily accessible to the exploring probe of standard designs of surface finish recording instruments.

Fundamentally the process consists in taking a plastic replica of a machined surface on a strip or film of cellulose acetate, and the impression thus obtained is measured directly by means of a stylus recording instrument. The accuracy of reproduction is quite good, but there is a slight reduction in depth, due to shrinkage of the plastic film, which in general amounts to about 10% of the total depth for machined surfaces.

THE use of plastic replicas in assessing the roughness of surfaces has been explored to no small degree in recent years by investigators both in this country and in the U.S.A.

The present investigations relate to the suitability of this technique for the measurement of the finish of large engineering components, such as marine gear teeth and the flanks of master lead-screws, which are not readily accessible to the exploring probe of standard designs of surface finish recording instruments. Fundamentally, the process consists in taking a plastic replica of a machined surface on a strip or film of cellulose acetate, and the impression thus obtained is measured directly by means of a stylus recording instrument.

The present paper discusses the application of this technique to both flat and curved surfaces, its accuracy of reproduction, and the measurement of typical components. The surface profile records illustrated in this paper have been taken using a Talysurf instrument.

The Replica Process

To obtain a replica of the finish of a surface, either of the following methods may be employed:—

(a) The thermo-setting method, whereby a plastic material is moulded on to the surface by the application of heat and pressure,[1] or

(b) A softening method where plastic material (the surface of which has been softened by the application of a suitable solvent) is pressed into contact with the surface to be tested and allowed to set hard in situ.

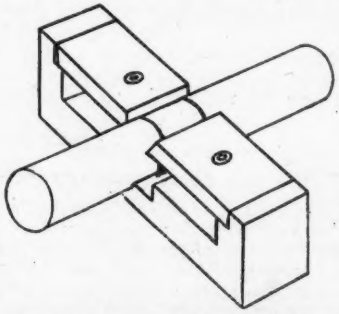


Fig. 1.—Jig as used for clamping plastic film during measurement.

The present investigations have been carried out using the latter method, which appears to have a more general application. Several plastic materials and solvents have been used in this connection by different investigators, but that used at the National Physical Laboratory is ordinary cellulose acetate in the form of

(1) J. Pearson and M. R. Hopkins, "Plastic Replicas for Surface-finish Measurements." Iron and Steel Inst., May, 1948.

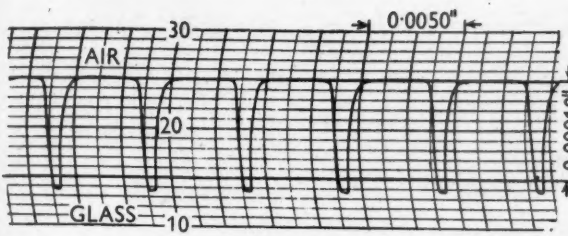


Fig. 2a.—Chart record of etched glass standard of groove depth 115 micro-inches (0.003 mm.)

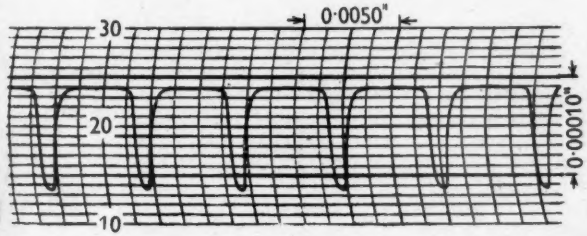


Fig. 2b.—Chart taken from a replica of the same standard (conversion factor, 1 in.=25.4 mm.)

sheets or thin films.[2] The solvent employed as a softening agent is basically acetone. In its pure state this solvent is unsatisfactory owing to its rapid action on the acetate material and to its high volatility, which causes "blooming" and other associated troubles. To overcome this, a small quantity of cellulose acetate is dissolved in the acetone to provide a solvent of reduced activity and lower volatility. From 5 to 10 grams of cellulose acetate to 100 ml. of acetone has been found to give the desired results.

To obtain an impression of a surface,

[2] Obtainable from BX Plastics, Ltd., London, E.4, or Collingridge and Co., Ltd., Watford.

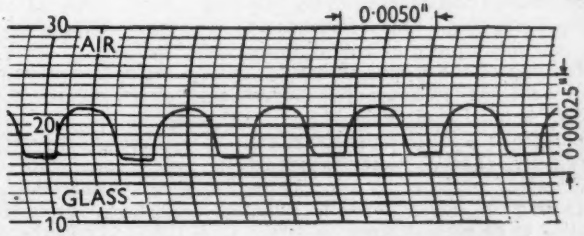


Fig. 3a.—Chart record of etched glass standard of groove depth 12.5 micro-inches (0.0003 mm.)

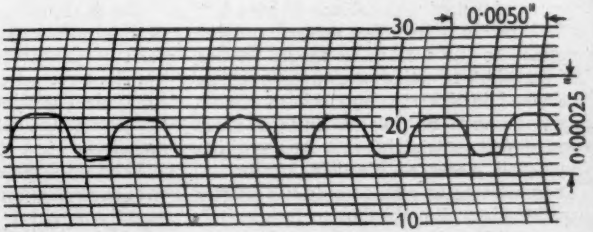


Fig. 3b.—Chart taken from a replica of the same standard (conversion factor, 1in.=25.4 mm.)

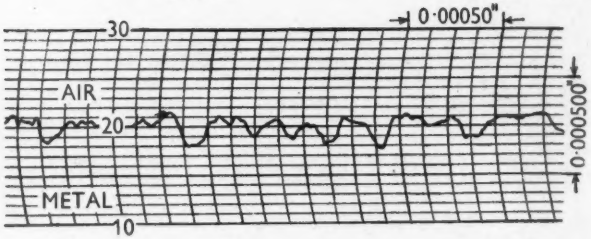


Fig. 4.—Chart record obtained from a replica of the turned finish of flank of a lathe-cut lead-screw.

which must be thoroughly cleaned beforehand, a few drops of solvent are placed on the surface with a camel-hair brush and a small piece of cellulose acetate sheet about 1¼ ins. by ¼ in. (32 mm. by 13 mm.) in size is then quickly placed in position and pressed down firmly until the excess solvent which is squeezed out at the sides of the sheet of acetate is seen to set. The pressure is released and the replica left in position for 5 to 10 minutes on the surface. The plastic sheet is then peeled from the surface and allowed to harden in the air for 30 minutes or so. The choice of thickness of the sheet to be used depends largely on the type of surface being examined.

Roughness Measurement of Flat and Curved Surfaces

For flat surfaces the most suitable form of cellulose acetate material for obtaining replicas is a rigid sheet of adequate thickness which prevents any distortion or cockling of the replica during "ageing" over the first few hours after preparation. The material used at the N.P.L. for this purpose is ⅛ in. (3 mm.) thick, cut into suitably shaped pieces about 1 in. (25 mm.) or 1½ ins. by ½ in. (38 mm. by 13 mm.). This material is sufficiently rigid to be pressed down on to the surface, and wetted with solvent without fear of distortion. Sufficient solvent must be applied to the surface to ensure wetting of the whole of the plastic strip. A replica obtained in this thick material needs no special mounting in the surface finish instrument beyond holding it in position by small pieces of Plasticine.

An alternative method is to use thinner acetate sheet, but this has to be specially mounted for subsequent measurement. For this method, sheet of thickness 0.01 in. (0.3 mm.) or 0.02 in. (0.5 mm.) is cut into strips about 1½ ins. (33 mm.) by ½ in. (13 mm.) wide.

In applying these strips to the wetted surface care must be taken to ensure that even pressure is applied and that no solvent spreads on to the back of the replica to spoil its smooth, flat surface. The pressure in this case is applied with a rubber-covered roller squeegee or a flat rubber squeegee consisting of a piece of $\frac{1}{16}$-in. (1.5 mm.) thick rubber sheet cemented to an aluminium strip. When set, the replica should be peeled from the surface and mounted, face upwards, in a jig, as shown in Fig. 1. This jig is designed to clamp the replica tautly round a lapped cylinder so as to prevent any tendency for the film to cockle on air hardening. The jig is supported by two equal V-blocks clamped to the worktable of the Talysurf instrument so that the axis of the cylinder lies under the exploring probe and parallel to its direction of traverse.

An adaptation of this method consists in mounting the piece of film in the jig beforehand and taking the impression by pressing the jig on to the wetted surface. This method enables the thinner film to be used with less risk of cockling.

Chart records obtained from replicas of this nature should be examined only for surface texture, since the presence in the chart record of waviness may be due to slight cockling of the film during hardening and not be entirely due to actual waviness in the surface under test.

The thin acetate film 0.01-in. (0.3 mm.) thick, already mentioned, and subsequently mounted in the jig for measurement, is the most suitable means for

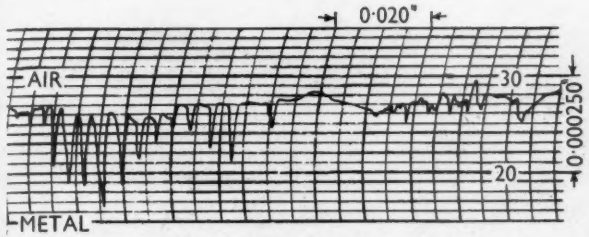


Fig. 5.—Hobbed finish of a helical pinion, from a replica taken in the axial direction.

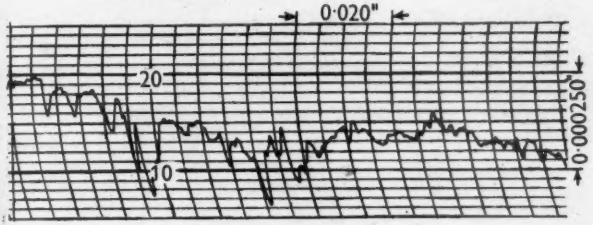


Fig. 6.—The same tooth, recorded in the radial direction.

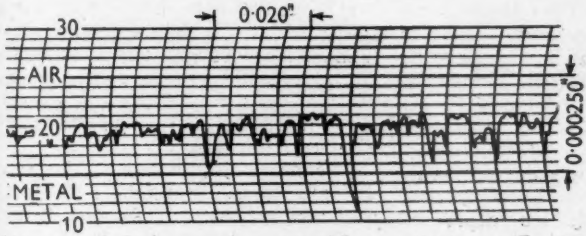


Fig. 7.—The same tooth, after shaving: record taken in the axial direction.

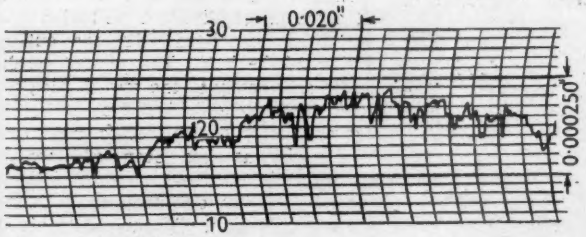


Fig. 8.—The same tooth, after shaving: record taken in the radial direction.

measuring the roughness of curved surfaces by the replica process.

Accuracy of Reproduction

To determine the accuracy of reproduction possible with the replica process, experiments were made with the N.P.L.-type of etched glass standards which are used for calibrating stylus recording instruments and consist of a series of lines of known depth and shape and etched on glass. The two records in Fig. 2 show the profile of the etched grooves of such a standard with a groove depth of 0.00012 in. (0.003 mm.). The upper record was obtained directly from the glass plate and the lower one from a plastic impression of it. It will be noted that a slight shrinkage has occurred in the surface of the plastic replica, as

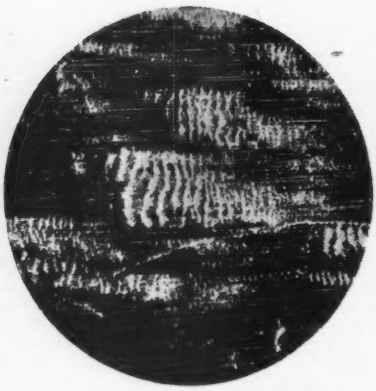


Fig. 9.—Enlarged view of hobbed finish of helical pinion tooth flank referred to in Figs. 5 and 6. Mag. ×17.

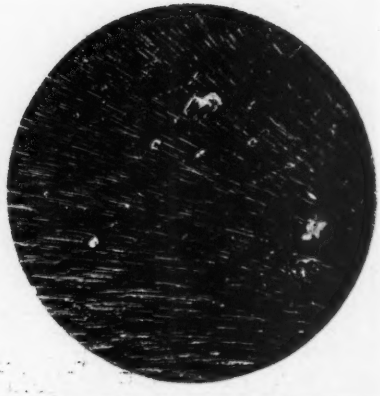


Fig. 10.—Enlarged view of the same tooth surface after shaving. (See Figs. 7 and 8.) Mag. ×17.

indicated by the small diminution in the depth of the etched grooves. This was found to be fairly consistent over a large number of trial experiments and in general does not exceed about 10 per cent. of the total depth for machined surfaces.

Fig. 3 represent similar measurements taken on a finer grade of etched glass standard with a groove depth of 0.000012 in. (0.0003 mm.) The results in Figs. 2 and 3 serve to illustrate the accuracy of reproduction of this technique both in regard to the depth and shape of surface irregularities. The shrinkage which occurs may be disregarded for all normal uses of this process.

Roughness Measurements on Typical Components

Figs. 4 to 8 illustrate the scope of the replica technique when applied to different types of components.

For example, Fig. 4 represents a turned finish on the flank of a square-threaded lead-screw of $\frac{1}{2}$ in. (12.7 mm.) pitch, used for controlling the hob saddle motion of a gear hobbing machine. For this particular type of measurement the $\frac{1}{8}$ in. (3 mm.) thick material cut into strips about 2 in. (50 mm.) long by $\frac{1}{2}$ in. (13 mm.) wide was found to be the most suitable.

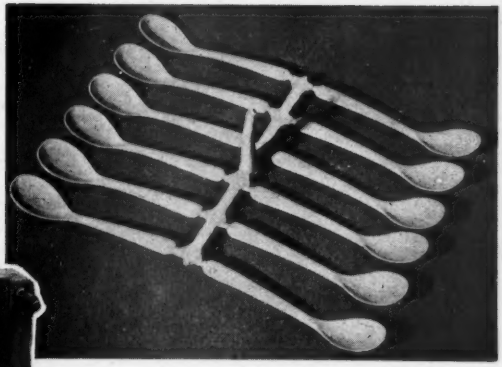
Figs. 5 to 8, obtained from replicas using film of 0.01 in. (0.3 mm.) thickness, show the axial and radial tool texture irregularities produced on the tooth surfaces of a helical pinion by hobbing and shaving respectively.

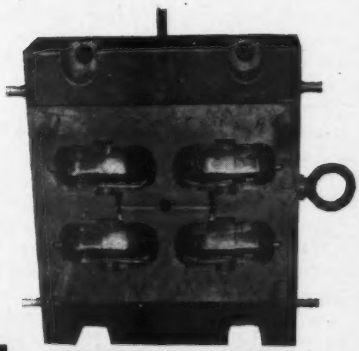
The main object of gear shaving is to improve the quality finish of the tooth surfaces by reducing the undulations arising from inaccuracies in the gear machine and to eliminate the tool texture variations associated with the cutting action of the hob. The present results relate specifically to the measurement of tool texture, and in this particular example it is of interest to note that whilst shaving has been effective in reducing the more random variations, the irregularities, due presumably to the shaving operation, still amount to about 0.0001 in. (0.003 mm.) in total depth.

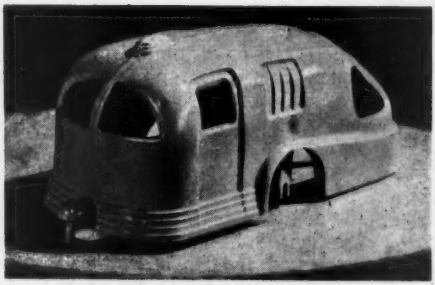
Figs. 9 and 10 are photographic enlargements of the actual replica impressions at a magnification of 17. The hobbed finish (Fig. 9) shows clearly the predominant surface irregularities which lie approximately parallel to the tooth helix. The abrasion marks superimposed on these irregularities are due to the tearing action arising from the blunt teeth

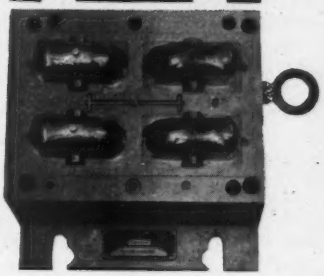
(*Continued on page* 44)

Injection Moulds and Mouldings









Illustrations of finished multi-impression moulds, side by side with the actual mouldings produced, are not frequently published. By courtesy of Fox and Offord, Ltd., Alma Street, Aston, Birmingham, 6, we show some typical work produced on the Gorton copy miller, namely, a 12-impression injection mould for egg-spoons, and a 4-impression injection mould for a toy trailer caravan (the latter in the "Palitoy" range of plastic toys, Cascelloid, Ltd.). The Gorton copy miller was exhibited by Alfred Herbert, Ltd., at the Machine Tool and Engineering Exhibition held in London earlier this year.

Marking Processes and Media for Plastics—III

By E. E. HALLS

In this instalment the author proceeds to discuss rubber and gelatine transfer marking processes, and also contrast marking by abrasive blasting or by solvent etching.

RUBBER and gelatine pad printing processes are inexpensive and convenient for applying ink or paint markings. They readily lend themselves to application to irregular surfaces, such as tubular or spherical curves. Further, there is no question of heat or pressure, and so they can be used where these are not permissible, due to the susceptibility or fragility of the article. Quick-drying, strongly adhesive inks or paints are required, and these are perhaps the most intricate part of the process.

These processes are generally used for the rapid transfer of markings which cover a small area, such as code numbers, trade marks, small designs and the like. In the rubber-pad method, the pad carries the marking as raised rubber letters, numerals or design. In the gelatine-pad process, the pad is a smooth surface on which the design is picked up from an engraved plate. It will thus be noted that there is a fundamental difference, although both can use the same type of ink.

Rubber-pad Transfer Processes

With black coloured markings, ordinary opaque printers' ink is quite often used for simple designs, and applied in the easiest way, i.e., picking the ink up from an absorbent pad on the rubber stamp and transferring it to the job direct with an appropriate locating device. This procedure has several severe limitations. The black inks are probably the only ones that are sufficiently homogeneous in composition to transfer from an absorbent pad to the rubber stamp in this way; with coloured inks the pigment separates too easily. Moreover, with the coloured pigmented inks, generally only a halo of the desired marking is obtained, the pigment pressing away from the centre of the line of the character to give a clear centre with a pigmented periphery.

The blacks do not always "dry" quickly on non-absorbent surfaces, and when dry only lay on the surface without any true adhesion, so that they easily rub off, e.g., they can be rubbed off gradually with finger pressure as quite distinct from abrading or scraping off the surface. This procedure is very restricted in application, is used only when the cheapest of markings is required, and generally has to be protected by an overcoat of lacquer or varnish.

More usually, therefore, a varnish, enamel or paint-base ink is used, pigmented to the desired colour, and having, as explained earlier, an oil-modified resin base to suit the plastic to which applied, plus a proportion of solvent to give the necessary "bite" into the material. This type of ink is distributed evenly over a roller, from which an even film of controlled thickness is applied to the design on the rubber. In turn, it is transferred from this to the job. Simple hand-operated machines can be built to suit this type of work, or purchased, in which the article to be marked is placed in its location on the machine. A double motion to and fro of a wheel or level completes the marking, i.e., as the work is travelled forward on to the rubber stamp, the roller coats the stamp and the latter transfers the impression to the work; as the work recedes the roller is re-inked ready for the next marking.

Numerous machine designs are available to suit standard shapes and sizes of article, or designs can be modified to

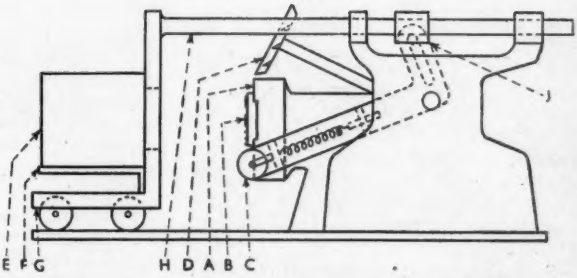


Fig. 1.—Principle of operation for one type of rubber stamp marking machine.

cater for specific jobs. One type is shown diagrammatically in Fig. 1. A rigid member (A) carries a rubber stamp (B), the latter being built up from characters as required, or it may comprise one or more patterns. It is mounted in a vertical plane, and is inked by the roller (C), which, in turn, picks up a uniform coating of ink from the pad (D). The article or material to be marked (E) is located in position on the platform (F), the surface to be marked being vertical and towards the rubber stamp. This locating platform is mounted rigidly on the carrier (G), which has a wheeled base and is provided with horizontal guide rods (H).

As the work is placed in position the platform is simultaneously pressed forward, the mechanism being very light and free running. During this forward motion the guide arms (H) operate the lever arm (J) of the roller, and the latter travels over the rubber stamp and then over the ink supply pad. The work picks up its marking, and as the pressure is relieved, a spring return brings the platform back to its initial position, the work is removed, and at the same time the roller returns and re-inks the stamp. The carrier of the ink supply pad (D) is provided with ratchet teeth, so that it revolves about one-eighth of a turn for each traverse of the roller; this avoids uneven wear and promotes uniform coating. The inking roller is of gelatine composition, and can be cleaned with petroleum benzine occasionally. The rubber stamp is cleaned thoroughly in industrial methylated spirit as required. The inking pad can be renewed when worn; it requires an application of ink every few hours.

The machine is provided with means for accurate setting, in order to produce accurately positioned markings of the desired thickness. It has the advantage that it can accommodate other than flat surfaces, e.g., curved or rounded objects. For this the rubber stamp is floated to enable it to recede upon first contact. In this way, all the characters are reproduced with equal clarity and with no blurring.

Using appropriate formulated "inks," such as those designated "dial enamels" or "dial printing inks," neat and adherent coatings are secured; they are dry enough for handling within a few minutes, although it may be several hours before they fully dry and mature to maximum adhesion and toughness. Generally no overcoat of varnish is required, although it can be adopted for specific purposes.

Multicoloured impressions have to be obtained by passing the work in succession from one machine to another, having, of course, identical location. It is practicable to add the necessary multiple inking tables, rollers, and pads to one and the same machine.

Gelatine Transfer Processes

The gelatine or matrix transfer marking processes invariably employ a highly pigmented, gloss/gum/oil base enamel, finely ground and of thick consistency, with rapid drying properties when applied in thin films. The "gum/oil" base and the ink is filled into an engraved matrix, and from there it is picked up

on a gelatine pad and transferred to the article.

Like the rubber stamp method, the gelatine transfer process is a quick operating one. Media in any colour can be employed, and multicoloured effects require only the necessary number of matrices on the one machine. The same gelatine pad can pick up the various colours and transfer them in succession to the same object.

Several forms of machine are possible. For example, the gelatine pad, with vertical movement, may be fixed in the horizontal plane, and the matrix and the work brought in succession into exact location beneath it. Alternatively, the matrix and work may be fixed, and the gelatine pad be capable of swinging round through a horizontal plane to locate over them successively, dropping vertically to contact them.

One form of the machine is illustrated diagrammatically in Fig. 2. It consists essentially of a vertical pillar on a rigid base, the pillar carrying on the same swivel collar two arms at right angles, each arm with a horizontal table. On one of these tables is accurately located the matrix; on the other, the work to be marked. Above this combination, is carried the gelatine composition pad in a horizontal plane, but with vertical traverse, and actuated by a hand-lever with spring return.

All the necessary adjustments are provided in three axes for precise location, so that, in operation, the work is dropped in its location on the table, the gelatine pads is brought down onto the matrix for an instant, the tables rotated, and the pad then brought down onto the work for an instant. The work is thus accurately and boldly marked, and the marking is dry for handling within a fraction of a minute, and for packing within a few minutes.

The gelatine is the normal medium-hard printer's composition. The pads are made by melting the gelatine carefully, without overheating, and pouring into a mould of the desired shape. The latter may be of wood or metal, slightly

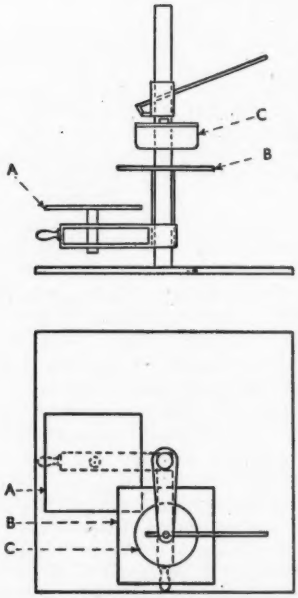


Fig. 2.—Matrix marking machine with gelatine pad.

moistened with lavender oil. The wooden backing plate, with anchoring recesses or preferably projections, is lowered into the melt so that the latter slowly cools and casts itself to the backing plate.

The matrices from which the markings can be picked up on the gelatine pad are made from flattened brass or steel, about $\frac{1}{8}$-in. in thickness. The depth of engraving on these matrices is about 0.005 in., and the surfaces after engraving are thoroughly smoothed out with blue-back emery paper or its equivalent, this being to ensure the removal of all burrs from the design.

In use, the matrix in position on the machine is wiped with a cloth moistened with solvent such as American turpentine or oil of lavender. The "ink" is spread on the matrix and excess is then removed with a palette knife. The inked matrix is then ready for use and does not require re-inking for each impression

taken from it; on the average, from three to eight transfers can be taken.

For simple markings, especially those comprising numerals and characters, the rubber stamp process is generally more convenient and economic. For very small markings, and for complex designs, the gelatine transfer process is preferred.

The cleaning of the gelatine pad is determined by conditions. If the impression is cleaned off very frequently it is done by wiping with a cloth moistened with the minimum of water. The pad is then sprinkled with a little French chalk and the excess wiped off with a soft, dry cloth.

Although the transferred impression is dry for handling and packing within a few minutes, it is not fully hard for from 3 to 24 hours. Some types of "ink" are designed for oven drying, from one to two hours at 120-125 degrees C. being allowed. Such markings are very suitable for "Bakelite"-type mouldings, and components from laminated.

For important markings, such as those giving information on electrical connections, e.g., on condenser tops and transformer terminal plates, the marked surface is coated with clear varnish by brushing or spraying, and the components are then baked. Glyptal-type synthetic varnishes are admirable for this purpose; characteristics are given in Table 1. It is stoved for 1 hour at 120 degrees C. The marked component has excellent durability, marking is fully adherent and resistant to abrasion, and will withstand the cyclic testing of W.T. Board Specification No. K110.

Characteristics of some of the "inks" for the matrices of the gelatine transfer marking process are given in Table 2. It will be seen that they are all heavily pigmented and are low in volatile solvent content.

Fig. 3 shows one form of the gelatine matrix marking machine, complete with tools. The vertical movement, with adjustment for the gelatine pad, is clearly seen; likewise the easy swivel motion for the horizontal swing of the matrix and work tables. The tools include gelatine pads of several sizes and palette knives.

The letterpress process of printing is also used on plastics. Here, special oil-base inks are employed, comprising gum-oil varnishes in which are incorporated driers, pigments and solvents to

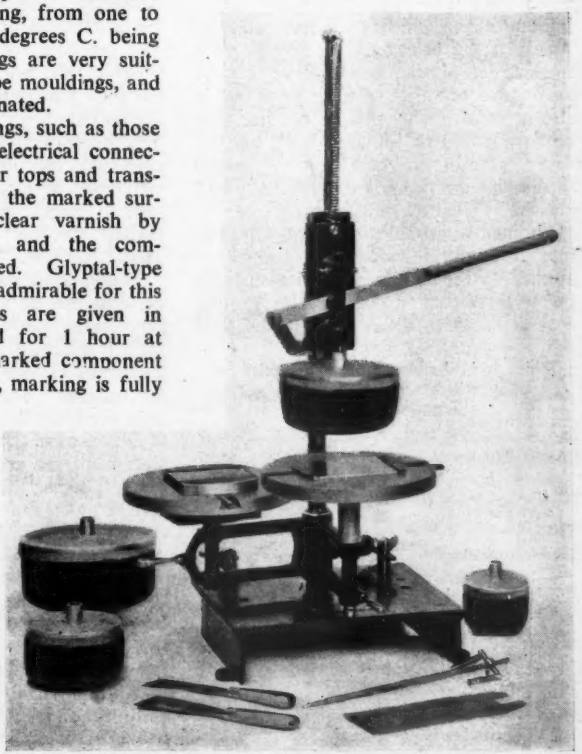


Fig. 3.—Gelatine pad matrix marking machine, complete with tools.

give best adhesion, compatability with the plastic, and appropriately rapid drying time. One of the most intricate factors is that of producing an ink of sufficiently delayed drying to be suitable for application and, after application, to be sufficiently rapid drying to enable the work to be handled quickly. Another problem is to produce inks of this type that will merge with the plastic surface as contrasted with one that merely hardens by polymerizing upon the surface.

An alternative procedure to get round this difficulty, as distinct from solving it, is to coat the printed surface with a lacquer or varnish, in the form of a solvent solution of a plastic, the latter being compatible with the base material and the print without causing the latter to bleed. It can be applied by spray, flooding or roller, according to circumstances. Again, if the printing is in reverse on a transparent plastic, this coating may be an opaque one that sets the print out in strong relief. The opaque coating may be formulated to imitate metal, e.g., by using aluminium or bronze powder media, or grained-wood patterns which may be applied by transfer processes.

Grained-wood finishes, closely imitating the natural wood, are commonly applied to the top faces of flat surfaces by a three-coat process. The ground coat is tinted to be as close to the final

Table 1.—Laboratory Characteristics of Clear Synthetic Lacquer for Top-coating Transfer Markings

COMPOSITION	Per cent.
Volatile spirit (loss in weight, 3 hrs. at 110°C.)	52.7
Total solids (glyptal/urea resin base, and dryers)	47.3
	100

PHYSICAL CHARACTERISTICS	
Viscosity at 25°C.	173 centipoises
Specific gravity at 25°C	0.958
Diluent	White spirit
Stoving conditions	½–1 hr. at 120/125°C.

Table 2.—Laboratory Characteristics of Air Drying, Oil-base Enamels, suitable for Gelatine Transfer Marking Process

	White per cent.	Yellow per cent.	Red per cent.
Volatile spirit	19.0	20.8	17.1
Pigment	67.2	61.9	69.2
Oil, gums and driers	13.8	17.3	13.7
	100.0	100.0	100.0

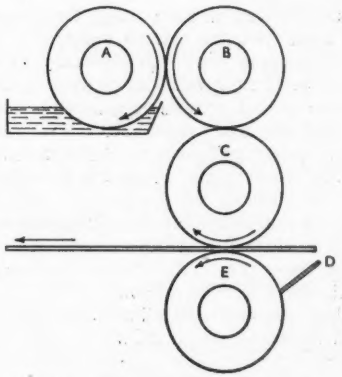


Fig. 4.—General principle of simple roller coating arrangement.

colour as possible. The middle coat is a reproduction of the grain of the wood. The top coat serves to fix the latter, to provide final adjustment of colour, and to give the required degree of gloss. Depending upon the base material, one of a number of types of media may be employed, including those of cellulose or synthetic base. The modified alkyd varnish media, air dried or baked, are perhaps the best, and can be used on plastic surfaces.

The ground coat for imitation wood patterns can be applied by roller, or by spray, and allowed to dry. The "graining" is likewise applied by roller, using a selected sample of wood as the matrix for transfer. The wood pattern of suitable size is finished perfectly smooth, and is then used in the same way as the metal matrix for the gelatine pad transfer process. That is, the enamel-type "ink" is spread on it and excess scraped off, and the pattern is picked up by the gelatine roller for transfer to the ground-coated surface. After allowing appropriate drying conditions, the top coat is applied, by roller or spray, and allowed to dry.

In repetition work, economic success necessitates a close study of the dimensions of the wood matrix in relation to the diameter of the roller and provision of accurate location. The roller

equipment is illustrated diagrammatically in Fig 4. Here the gelatine composition "pick-up" roll (A) takes up the varnish medium or ink from the reservoir tray (F) and transfers it to the steel distribution roll (B), which spreads it evenly over the gelatine composition coating roll (C); the thickness of the film can be adjusted by setting the clearances between the rolls. E is a steel or rubber driving roll; D is a scraper or cleaner for removing any medium from the drying roll, contamination being liable to occur in the interval between the feeding of successive samples.

For the transfer operation for the graining coat the system is simplified to two rolls, a rubber drive and a gelatine pick-up roll. The matrix is first passed through; then the panel to be coated.

Contrast Marking by Abrasive Blasting

Contrast impressions can be obtained by abrasive blasting, using sharp sand, siliceous flint or crushed steel shot which gives an angular grit applied in a stream of compressed air. A contrast of natural or polished surface against a roughened one is thus obtained. Either the pattern or the background can be the masked area. Masks are of rubber or polyvinyl chloride for best resistance to the blast, or they may be of metal. Blasting can be controlled in uniformity and depth, the latter most easily by a timing device.

The most successful processes use low-pressure blasting with the abrasive gravity fed into the air stream. Sharp siliceous flint is preferred; crushed steel shot is prone to leave tiny iron particles embedded in the plastic, and these may rust by exposure and so cause staining. These blasting processes are more satisfactory on homogeneous resin products such as the thermoplastics and the thermosetting cast resins, and less suitable for thermosetting mouldings and laminates.

Solvent Etching

Etching is possible on solvent-susceptible materials. It has been used on cellulose acetate plastics, especially sheeting. In this process, the areas of the pattern to be "etched" are blocked or shielded by means of a resistant coating. The remaining areas are then etched with suitable solvent to the required depth. The etched areas are then filled or coloured as required. Finally, the resistant coating is removed, to leave the pattern in high light against the coloured background relief. The "resistant" coating can be applied by hand by the equivalent of the sign-writing method, by stencil, hot foil process, printing method, silk screening or other convenient process.

The etching method gives a pattern consisting of the original material, in fact, complete with its original surface; it is permanent and as indestructible as the material itself.

(*To be continued.*)

A NEW LAMINATE FOR MERCHANDISE CRATES

(*Continued from page* 11.)

not splinter either by nailing or screwing; is waterproof, and can be given either a matt or a polished finish.

The last-named property makes the new laminate ideal for crates containing merchandise which requires a perfectly smooth, even surface around it; this contention is borne out by the fact that British Celanese use it themselves for the crating of many of their own products. The laminate stands up perfectly to tropical conditions and to any amount of wear and tear and, therefore, on account of its quality the crates made from it must be considered as returnable crates.

At present "Celastoid" sheeting/hessian laminate is only produced in grey, but other colours are possible. The laminate guillotines satisfactorily and can easily be formed. There is every possibility that, with a better supply of the essential raw materials, there are many other uses and adaptations, commercial and domestic, to which this remarkable achievement may be applied.

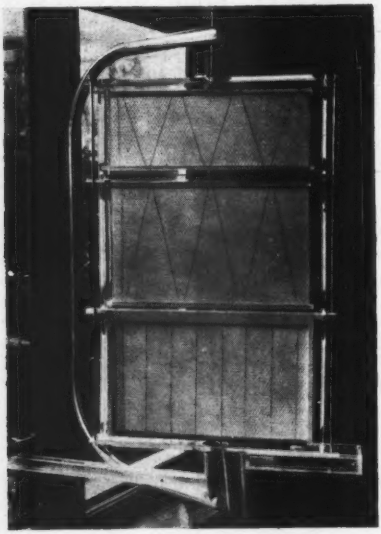
LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Observation Bee Hive

Sir,—You may be interested to know that we are gradually developing a whole range of bee appliances in "Perspex," partly to replace the ones previously made in metal or wood, and partly as new appliances.

The accompanying illustration shows the window model of the "Stanley Patent All-Perspex Observatory Hive." This hive is made in three "units," each of which contains a bee frame. These units



are held together with rods and wing nuts. The hive is pivoted in the arms of a chromium D-bracket, which screws on to the window frame, and is free to rotate. The bees gain access via a "Perspex" tunnel, which fits into the bottom tube and passes through the window or frame. Syrup or honey can be fed to the bees by means of a feeder which slides along the bottom. Ventilation slots are provided in the walls and top. No part of the hive is obscured to vision, and it cannot be knocked over. Bees live in the hive all through the summer and autumn.

Since we introduced these hives about 12 months ago, over 400 have been sold to beekeepers, schools and institutions. We are now selling quite a number abroad. BADGERDELL APIARIES.

Barnes Lane,
King's Langley, Herts.

Plastics in the New Year

Sir,—In the year that has passed the British plastics industry has achieved official recognition for the part it plays in the economic life of the country. The Organization for European Economic Co-operation has advocated the expenditure of £200,000,000 on the development of the chemical industry, and the increase in plastics production to three times the 1938 figure.

The overall picture of British production presents a picture of which we may be proud, for against a fall in output in some industries, plastics production in this country has doubled since before the war. The time has come for us to press with increasing vigour for public recognition of our power and importance to the economic life of the country. As our products advance with technical and design improvements, so this recognition of the value of the British plastics industry will achieve greater power abroad.

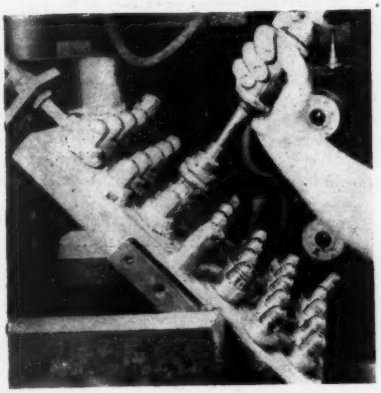
It is my firm belief that our young and vigorous industry is destined in the coming year to reach even greater heights.

To our friends in the plastics and allied industries we send greetings for the New Year, and the hope that it will bring personal happiness and public prosperity.

J. EERDMANS, Managing Director,
De La Rue Insulation, Ltd.
Imperial House, 84 Regent Street, W.1

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes



PNEUMATIC TOOLS.—The particular advantages offered by certain types of pneumatic tools are best emphasized by drawing attention to special instances of usage. The accompanying illustration shows a reverse-drive Mighty Atom screwdriver in use in the plastics industry for the sole purpose of removing bottle screw-caps from the mould. This particular tool is one among the range of pneumatic tools made by Desoutter Bros., Ltd., The Hyde, Hendon, London, N.W.9.

CO-OPERATION IN INDUSTRY.—By mutual arrangement the sole selling rights of Sigma instruments in the home market will be transferred from E. H. Jones (Machine Tools), Ltd., London, to Alfred Herbert, Ltd., Coventry, as from January 1, 1949. E. H. Jones will be the sole export distributors for Sigma measuring instruments and the sole agent, home and export, for the Sigma milling and drilling machine.

O. AND M. KLEEMANN, LTD.—The final dividend for the year to August 31 last is reduced to 120 per cent. (from 150 per cent. for 1946-47), making a total distribution of 240 per cent. (270 per cent). Net profits declined by £95,740 to £408,847, of which £225,577 (£290,033) is required for tax.

BRITISH MOULDED PLASTICS, LTD. Mr. William S. Hindle, secretary of the Company, is taking up the appointment of financial director, Colonial Development Corporation (West Indies), Ltd. Mr. Hindle will be leaving for the West Indies early in 1949 and Mr. A. W. Shawe takes his place as secretary of British Moulded Plastics, Ltd., as from January 1, 1949.

MONSANTO CHEMICALS, LTD.—Dr. L. F. Nickell, chairman of the Company for the past 18 years, has tendered his resignation to the board, as he intends returning to the U.S.A. Dr. Nickell came to England from the U.S.A. in 1930 to take up the appointment of chairman and managing director of Monsanto Chemical Works at a time of acute industrial depression.

SHAWINIGAN, LTD.—Mr. A. W. Scott, director of Shawinigan, Ltd., London, since 1945, has now been appointed managing director.

PETROCHEMICALS, LTD.—Sir Robert Robinson, F.R.S., President of the Royal Society, and Mr. W. L. Tregoning, industrial adviser to the Finance Corporation for Industry, Ltd., have both joined the board of Petrochemicals, Ltd. Sir Robert Robinson has also joined the board of Petrocarbon, Ltd., an associated company.

PROTOLITE, LTD., 93, Hope Street, Glasgow, C.2, have now removed to new offices at 144, St. Vincent Street, Glasgow, C.2 (phone, Central 6806).

REED BROTHERS (ENGINEERING), LTD., have appointed Topping and Henderson, Ltd., of Market Hall Chambers, Church Street, Eccles, nr. Manchester, to represent them for hydraulic, rubber and plastics machinery in the Manchester and North-Western areas. Until recently Mr. Topping was the Manchester area manager of Geo. Cohen, Sons and Co., Ltd., with Mr. Henderson as his assistant.

L. KEIZER AND CO., LTD., plywood importers, 158, City Road, London, E.C.1, inform us that their new address is 195-7, Aldersgate Street, E.C.1 (phone, Monarch 0311). All departments, including plywood, wallboard and plastics, will now operate from this address.

STRAMIT BOARDS, LTD.—Mr. J. F. Souhami has been appointed manager of Stramit Boards, Ltd., Stowmarket, Suffolk. His experience of non-traditional building

boards will ensure that the trade has up-to-date knowledge of this development in the industry. Productive capacity of the works has now been increased, with the installation of two new board-making machines.

LACRINOID PRODUCTS, LTD.—The Dramatic Society attached to the Lacrinoid Social Club gave three performances of "The Ghost Train" at the company's works at Gidea Park, December 9-11.

MR. VIVIAN STANNETT, author of the series, "Cellulose Acetate Plastics," appearing monthly in "Plastics," has asked us to state that his new address is 222, Columbia Heights, Brooklyn 2, New York City, U.S.A.

EXPORT INQUIRY.—Bishamber Dass and Sons, Post Box 275, Chandni Chowk, Delhi, India, are keenly interested in imports of plastic sheetings and thin films, beltings and other extrusions of all types, and moulding materials. Their managing director, Mr. A. P. Jain, has recently arrived in England by air to make bulk purchases during his two months' stay. Suppliers may contact him at Room 86, Grosvenor Court Hotel, Davies Street, London, W.1 (phone: Mayfair 7172.)

PLASTICS INDUSTRY GOLFING SOCIETY.—A dinner-dance-cabaret will be held at the Savoy Hotel, London, on Friday, April 1. All members are invited to bring their guests. Applications for tickets (£2 2s. each), which will be dealt with in strict rotation, should be made with remittance to Hon. Secretary, Plastics Industry Golfing Society, 18, Grosvenor Gardens, London, S.W.1.

NOTES FROM THE BRITISH PLASTICS FEDERATION

Resignation of Secretary

The Secretary of the Federation, Mr. G. M. Knight, has been offered and has accepted an appointment to his advantage and has, consequently, submitted his resignation. The Executive Committee has accepted his resignation with great regret.

Moulders' Group

The North-West Sub-section of the Moulders' Group held their annual luncheon on December 10 at the Grand Hotel, Manchester, following a meeting at which an interesting discussion took place regarding the development of reciprocal business between the members and their associates. At the luncheon the Vice-chairman of the Federation, Mr. P. A. Delafield, replied to the toast of the Federation, and Mr. N. B. Punfield replied on behalf of the guests. About 40 persons were present.

FORTHCOMING MEETINGS

Jan. 14.—"P.V.C. Pastes." Lecturer from I.C.I. Plastics Division. Plastics Institute, Scottish Section.

Jan. 18.—"World Trends in Plastics." A. Renfrew (I.C.I., Ltd.). Plastics Institute, London Section. Waldorf Hotel, Aldwych, W.C.2.

Jan. 19.—"Petroleum and the Plastics Industry." Dr. Steiner. Plastics Institute, Southern Section. Polygon Hotel, Southampton.

Jan. 19.—"Most Recent Developments in the Plastics Field." Maldwyn Jones (I.C.I., Ltd.). Plastics Institute, Yorkshire Section.

Jan. 19.—"Synthetic Fibres. Historical Survey of the Development of Synthetic Fibrous Materials." H. V. Potter. Society of Chemical Industry. Joint Meeting of London Section and Plastics Group, repeating the Society's Jubilee Memorial Lecture. Royal Institution, Albemarle Street, W.1.

Jan. 21.—"Applications of Acrylic and Vinyl Pastes." Dr. Hetherington. Plastics Institute, North-Western Section. Joint Meeting with Institution of the Rubber Industry. Engineers' Club, Albert Square, Manchester, 2.

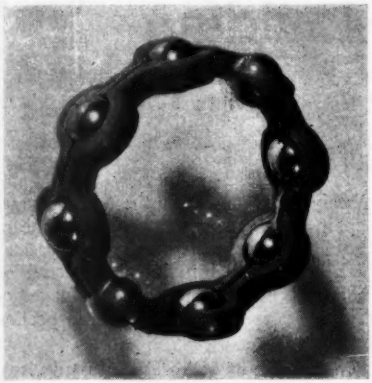
Feb. 2.—"Food Science in Evolution." L. H. Lampitt. S.C.I., London Section. Municipal College, Guildhall Square, Portsmouth.

Feb. 2.—"Relationship of Inspection Department to other Functions." W. A. Bennett. Institution of Engineering Inspection. Chamber of Commerce, New Street, Birmingham.

Feb. 3.—"Expanded Plastics." S. B. Turner (Expanded Rubber Co., Ltd.). Plastics Institute, North-Eastern Section. Neville Hall, Newcastle-on-Tyne.

Feb. 11.—"Adhesion and Adhesives." A. M. Jamieson. Plastics Institute, Scottish Section. Heriot-Watt College, Edinburgh.

New Productions from the Moulding Shops



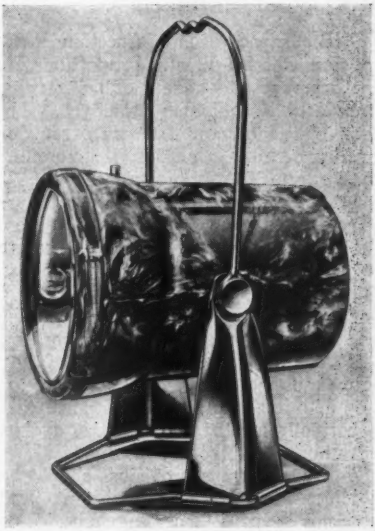
Ball-bearing Cages

The main qualities required in an anti-friction bearing cage are lightness combined with sufficient physical strength and, secondly, the material of which it is made must form a satisfactory frictional combination with the rolling elements. It is also necessary that the cage be designed so as to run in a central position, concentric with the bearing rings, and that the cage does not impede the access of lubricant to the working parts of the bearing. Where such bearings run at unusually high speeds, these requirements are not met by the cages normally fitted to ball and roller bearings unless special precautions are taken in respect to lubrication involving, for instance, oil circulation.

The need, therefore, exists for a cage which permits high speeds and yet is not over-sensitive to indifferent lubrication. The makers of "Skefko" ball bearings have, over many years, developed cages machined from fabric-reinforced Bakelite in the form of sheet or tube. Such cages, whilst satisfactory, are necessarily rather bulky, and to make the machining a practicable proposition, their external shape must be, in the main, cylindrical. Consequently the thought arose of moulding a cage to precisely the ideal shape from the point of view of easy access of the lubricant to the working parts. A moulded Bakelite cage of this description was developed by the Skefko Ball Bearing Co., Ltd., in co-operation with United Ebonite and Lorival, Ltd., using a shock-resistant fabric-filled moulding powder, and is now available in two sizes.

Lantern

The new 6-volt "Drydex" lantern marketed by the Chloride Electrical Storage Co., Ltd., is strongly built in marbled plastic and provided with an unbreakable clear plastic lens. The stand and handle are chromium-finished. The lantern is so mounted that, irrespective of whether carried in the hand or stood on the ground, the beam can be directed and fixed at any required angle.



Plastic Chairs in United States

One-piece plastic chairs (excluding the legs) are to be manufactured on a large scale by the General American Transportation Co., using sisal impregnated with phenolic resins. Based on sitting patterns taken by an industrial designer, these chairs are said to be suited to use in restaurants, schools, offices, theatres and public halls, as also for some domestic purposes. They are moulded in one large combined seat-and-back unit weighing about 5 lb. The company concerned hopes to adapt the process to use polyester resins, which should cut costs significantly; although polyester resins are more expensive, they have an advantage over phenolic resins in that they can be extended 50 per cent. with cheap fillers.

Quality Control in Plastic Moulding—XIV

By W. M. HALLIDAY

The author now proceeds to consider the requisite degree of organization which is needed to render quality control inspection most effective. He deals with the type of gauges employed and instruction in the use of same; component drawings and specifications; the submission of samples to the customer; and the functions of inspectors on the moulding-shop floor.

THE efficiency of any inspection operation will be directly proportional to the accuracy and quality of the gauging or measuring equipment employed. The first item to be considered in organizing quality control inspection is, therefore, the inspector's tools and gauges.

Whatever form of measuring tools are selected for the use of the inspector, steps should be taken to ensure that these are regularly tested for wear and for errors. It is preferable to allocate such a duty to another person rather than to allow the one who has to use the gauges to perform this essential task. Alteration of any gauge must be similarly placed under the care of one person, so that responsibility is correctly located and to guard against unauthorized tampering with gauges.

Adequate storage provisions should be obtained to prevent important and precision gauges becoming mislaid or damaged. A check should also be made of every gauge immediately it is returned to the stores, to ascertain if injury has occurred whilst in use, or whether the original setting has been disturbed.

Each gauge must be properly and plainly identified for its particular job, thereby eliminating the risks of a wrong gauge being employed. Where circumstances permit, a master tester gauge should always be provided at the outset of a production job to ensure master reference, against which the inspector's gauges can be easily checked for accuracy, etc. Such a reference gauge would never be issued for use on the moulding-shop floor.

Preferably, one person should be appointed to undertake the task of gauge repair and maintenance, and means should be provided whereby records may be kept of all such maintenance activities. This will assist in preventing damaged or faulty gauges being retained in inspection service.

In the case of delicately adjusted visual direct-reading measuring instruments of the kind already mentioned earlier in these pages, especial care should be taken. It might be found advisable not to locate these in the moulding shop at all, because of the risk of damage from contact with powder particles contained in the atmosphere, fumes, moisture and similar harmful influences.

Needless to mention, the very best workmanship should be put into all gauges and checking tools made-up in the works. Makeshift and approximately accurate tools should never be permitted, even if only to tide over an immediate urgent requirement.

In the case of moulded parts having dimensions which have to be retained within very close limits of variation, some moulders adopt the wise policy of having their inspection gauges for such portions of the product checked and approved by the client before issuing them for use on the moulding-shop floor.

If these precautions are taken, quite a large number of troubles and minor snags will be entirely eliminated from inspection procedure, much time will be saved, responsibility will be fixed, the quality of the component will be improved and the inspector will be able to fulfil his duties with greater assurance and faith in the gauging tools employed.

Instruction in the Use of Gauges

The next important matter refers to the steps which can be taken to ensure that every inspector is properly acquainted in the use of the gauges which are provided.

It is surprising what faulty work can be occasioned simply because the inspector is unfamiliar with the use of a certain gauge, or, perhaps, because he is applying the gauge wrongly. When a new set of gauges is issued to the inspection department, it should be the duty of some member of the staff to ensure that those inspectors likely to have to use the gauge understand fully its purpose and how it has to be applied. Simple instructions of this nature at the outset of an inspection operation will often obviate innumerable little difficulties, which, if allowed to persist, may lead to a serious mistake, or costly error, or oversight in respect of the mouldings to be gauged.

In order to avoid the above troubles, many large moulding firms issue written instructions with every new gauge supplied to the inspection department. This is a sound plan, but may not be possible in the case of a small works. However, it usually can be arranged that someone fully conversant with the requirements of the new job, and how the various gauges have to be used thereon, shall pass on this information to the inspecting staff.

Component Drawings and Specifications

Not only is it essential to transmit proper working instructions to the inspectors regarding the use and functions of any gauges; it is also vitally important that drawings, or specifications of the component part be issued for their guidance.

There should be no possibility of the inspector proceeding to a job already in production with doubts in his mind as to the scale of tolerances permitted on the job, or which portions of the moulding have to be gauged, and which are relatively unimportant.

It requires a very little amount of foresight and arrangement to ensure that full instructions on all these essential points are provided the inspectors, right at the beginning of a quality inspection operation. Yet so often one finds that production is allowed to commence without this data being vouchsafed to the inspector beforehand. This sort of thing is bound to result in defective work getting through, or in parts being rejected when in reality they are quite correct.

The condition of drawings of components issued to the inspection department may also have an important bearing upon quality control procedures. Vague, badly blue-printed, hazy or dirty drawings are a very fruitful source of mistakes on the part of inspectors. Frequently it will be found that when the master blue-print is consulted, say, to check some points on the inspector's drawing, a vital dimension or some other instruction has been mis-read, or even completely overlooked in the moulding shop.

Still further to promote the clean condition and safety of all such working drawings for the guidance of the inspector, proper storage and filing facilities should be provided.

Yet another important duty falling to the lot of the quality control supervisor and inspectors relates to the handling of drawings which have been subject to modifications. Very often when a moulding job is actually in production, the customer, or the moulding firm's design department, may decide upon some alteration to improve the moulding technically. Such action is, of course, very necessary on occasions, but if the shape or dimensions of the moulded component have to be changed it should be part of the duty of the quality control system to see that further moulding operations are shut down pending mould alteration, and the provision of new gauges, etc. The obsolete drawing of the unmodified component should be carefully filed away, and plainly marked to prevent its further use on production inspection.

Before leaving the subject of component drawings, a word or two must be said about tolerances. The question of fine limits stipulated on customer's

component drawings, especially in respect of dimensions or portions of a moulded article whose functioning in practice will in no wise be retarded, must be settled before production commences. Otherwise it may be found that considerable trouble has been gone to in securing adherence to close tolerances when the job does not justify such accuracy. If this point is definitely settled at the very outset of inspection and production operations, one of the sources of scrap and defects will be immediately removed. It need scarcely be pointed out that the finer the limits imposed, the greater the risk of faulty or scrapped parts.

Samples Submitted to the Customer

Another useful factor which is often of tremendous help to the quality control inspector in avoiding faulty work lies in having available a sample component which has been approved in all respects by the client. Such a sample can be used as a standard reference in all cases of doubt or argument about any feature of a particular moulding.

It is essential, however, to point out that the first one or two mouldings taken from a brand-new tool undergoing tests should not be sent to the customer for such purposes. It will be far more reliable to run the moulding tool for an appreciable period, the duration of this try-out depending, of course, upon the complexity of the mould, the degree of accuracy desired, the material employed, and the intricacy of the moulding technique.

Any sample submitted for the client's approval must be truly representative of what can be achieved under normal production from the mould. Such a sample should be carefully filed away with the specification and drawings, and gauges.

Charting Provisions

As already explained under quality control inspection, each moulding machine or press will be provided with a control chart, or several such charts, as the case may require. The inspector will make periodical visits to the machine, checking a number of samples at each visit. The results of such a check will be recorded upon the chart or graph.

Proper provisions must be supplied for holding the chart at the machine. Such provisions should ensure the chart is plainly visible to the machine operator, and that it is adequately protected against damage, or accidental smudging with dirt, oil or powder. The charts must be located in easily accessible locations. Suitable metal holders could be provided, these being firmly fastened to the machine or stripping stand, as convenient.

Provisions should be made to guard against unauthorized interference or tampering with the charts. They should be so disposed as to be visible from an appreciable distance, so that passing supervisors can see at a glance the condition of the production run.

A well-defined system of chart-plotting should be adopted. Any convenient method of denoting the variations in the quality of the product may be employed, of course, but it is highly advisable to have a uniform style throughout the works. It has to be remembered that the completed charts have to be filed away for future reference and, indeed, they constitute very valuable production data whose loss or damage would prove serious. All inspectors should be instructed in the necessity to keep such control charts clean and compiled in the most orderly manner.

Provisions should be ensured in the central inspection department for the safe storage of all completed charts, which, of course, would first be suitably identified with their respective production jobs. As far as practicable, standard control-chart sizes and layouts should be provided, thus assisting more orderly compilation and storage.

Transport

Transport is another aspect of moulding shop activity which has to be closely watched, and often is better organized under quality control methods of inspection.

Many moulded plastic components are

extremely delicate or fragile, or very easily scratched on their surfaces if allowed to contact hard, metallic corners, etc. It will be obvious, therefore, that if steps are taken to improve the quality at the source, i.e., the production moulding machine, by better inspection facilities, greater care must be observed when the finished and inspected articles are taken away to the stores to be prepared for dispatch.

Much minor damage, especially to surface finish, is caused by indifferent handling during transport, by workers not aware of the trouble which may result from throwing components into unsuitable containers or unduly severe handling. Therefore part of quality control organization should be to ensure proper transport and storage facilities for all the moulded articles. The nature of such facilities must depend, of course, upon the type and size of the article to be handled. It is mentioned here, however, because this point is often completely overlooked, and if quality control methods are instituted the benefits derived at the production end of the process may be nullified to a great extent by damage caused at the storage and dispatch ends of the process.

Passive Inspection

If possible, it is a great help in quality control inspection procedures if the inspector introduced on the job has some experience or knowledge of the production process itself.

Too often inspectors adopt a purely passive attitude towards their duty, regarding it as merely to determine whether components are correct or incorrect, and to report such facts to the proper quarters. Even with conventional forms of inspection, such an attitude is unhelpful, but with quality control methods it will certainly not be conducive to the best results.

With this improved form of inspection service the interest of the inspector should start with the commencement of the production, and he should regard it as within his province to watch the progress of each moulding job in all its stages, and to try to appreciate which mould variations or faults produce certain variations and defects in the component. He will be the one most closely concerned with the trends of every production operation, and thus is best in a position to gain such knowledge. Thus, possessing this knowledge he will often be enabled to proffer expert guidance to the mould operator, or even the setter, to assist in the quicker detection of mould errors, etc.

It is equally important that the inspector be instrumental in preventing the occurrence of faulty work, and be of assistance in more readily locating the causes of such faults, than in merely recording the scale and frequency of errors of any kind.

It is one of the features of quality control that greater facilities are presented to the intelligent and observant inspector for gaining such knowledge and experience, simply because mould-cause and product-effect are more closely tied up, and are also pictorially revealed on the control chart. This should be considered an essential part of inspector training under quality control instituted in the moulding shop.

Functions of Inspectors on the Moulding Shop Floor

Because inspection policy will vary from shop to shop and, indeed, in respect of different classes of moulding, only the general outlines of policy or organization can be suggested here.

The inspector will usually be allocated to supervise production from a number of machines. He should be clearly advised at the beginning of each new run, exactly at what periods he has to visit the machine to take samples, which gauges to employ, and all the essential data connected therewith.

It will be his responsibility to ensure that each batch of components thus sampled, and passed as correct at any given visit, is removed or otherwise safely isolated. He should also have the authority to stop further moulding

immediately the job passes out of control. This authority must be clearly understood throughout the works.

The inspector should be solely responsible for plotting all points on the control chart, such duties to be delegated only at the express sanction of a higher authority. This is a most important matter as will be self-evident.

All gauges after issue to the inspector will be his responsibility for safe keeping, and proper use, and again it should be understood that he is the only person to use such gauges for checking production moulded articles.

Design of Gauges

Very often the plastic moulder has to make up gauges or checking equipment himself. If he has been accustomed to produce such tools, etc., for use with ordinary inspection methods, unsuitable designs for use in conjunction with quality control may result.

Quality control methods require more precise information about the product and its method of production. It demands that the controlling inspection shall be able to determine in precise figures how much and in what direction a piece of work varies from the average size laid down for the job.

Thus two basic essentials of gauge design arise from these requirements: (a) The measurement taken from the component must be instantly visible, and (b) such a measurement must have a numerical value, or a readily computable value against some known standard.

These two factors or requirements should govern the approach to gauge design and construction for most quality-control requirements. If these are kept constantly in view by the tool designer charged with the task of providing gauges, and checking equipment generally for use under quality control, more suitable tools will be provided. It should also be noted that wherever possible gauge design should be kept as simple as possible, consistent with the above needs of course. Complicated types of gauges are more liable to fail, as well as usually involving more handling, or greater care in their use.

From the foregoing, readers will appreciate the need for greater all-round care and attention when quality control is being inaugurated, in order to ensure that adequate organization, along the lines suggested, is created.

Much of the organization here outlined is of a very simple nature; most of it capable of being adopted readily by the small moulding shop, and its operation incurs the minimum amount of clerical work. Where sufficient staff is available it is better to allocate certain specific duties to each individual. Where this is not possible very much can be done by the exercise of a little forethought to anticipate difficulties likely to arise for the inspector. To the degree which such inspection organization is made, so will quality control methods prove more effective and reliable. Finally, it is hoped enough has been indicated to show the various lines on which to proceed when setting up this form of inspection procedure.

In the next and concluding article, the author will describe and illustrate a few sample control charts from actual moulding operations.

(To be continued)

APPLICATIONS OF THE PLASTIC REPLICA PROCESS

(Continued from page 28)

of the hob. The shaved tooth surface (Fig. 10) is of interest since it clearly shows the divergent lay of the predominant surface irregularities relative to the gear pitch cylinder. The oblique striations faintly discernible in the region of the pitch cylinder represent the paths of contact between the shaving cutter and gear.

The work described above has been carried out as part of the research programme of the National Physical Laboratory, and this paper is published by permission of the Director of the Laboratory.

Photograph reproduced through the courtesy of Messrs. Humber Ltd.

THE MARK OF A NATIONAL PLASTICS COMPANY

This is the instrument panel of the new Humber Hawk. The centre portion, which houses the instruments and the radio controls, is a plastic moulding, made from phenol formaldehyde moulding material for Humber Ltd., by

BRITISH MOULDED PLASTICS LTD.
AVENUE WORKS • WALTHAMSTOW AVENUE • LONDON • E 4

B.M.120

'VULCAPRENE'

$$-\left[\left[O-(CH_2)_2-O-CO-(CH_2)_4-CO\right]_3-NH-(CH_2)_2-O-CO-(CH_2)_4-CO\right]_n-NH-(CH_2)_6-NH-CO-$$

A versatile synthetic polymer that is specially valuable for –

COLOURED LACQUERS FOR RUBBER SPREADINGS & MOULDED ARTICLES • LEATHERCLOTH • ADHESIVES SOFT, LIGHT, RESILIENT SPONGE MOULDINGS

Write for technical literature and samples to the nearest I.C.I. Sales Office

ICI

D.121

The Microscopic Examination of Plastic Materials

VII.—Mouldings (Contd.)

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

HAVING dealt with the coconut-shell wood-flour blended filler, the logical material to be next examined is a standard wood flour filled moulding, such as is in common use to-day. As is well known, this material is generally composed of a wood flour produced from Swedish soft wood of 80 to 100 mesh. The material has proved satisfactory over a long period of time, as a general-purpose moulding-powder filler.

The standard wood flour filler exhibits more or less characteristic behaviour which may be considerably modified in certain circumstances by the addition of other components to the filler. Such modification existed in the case of the coconut-shell flour-filled moulding, and in discussing the results of the examination of the standard material which follows, the behaviour of the blended filler will be used as a comparison to further illustrate modification in its behaviour.

In the first instance it is desirable to examine the structure of the material under low magnifications in order to obtain an idea of the general arrangements of the structure. Thus Fig. 353 illustrates a portion of a section from a wood flour filled moulding at a magnification of 26 diameters. It should be pointed out at this stage that the moulding which will be immediately discussed is a moisture-absorption specimen, produced from a standard moulding powder, containing the usual 45 to 50 per cent. of resin. The powder was pigmented and finally contained two grades, one of which was pigmented to a dark brown, while the other was impregnated. As can be imagined, this mixture of powders is helpful in elucidating the behaviour of the material as a whole, and we shall see subsequently brought to light some interesting information.

At low magnifications the general structure of this moulding shows a degree of homogeneity which is difficult to assess at the outset of the examination, for there appears to be a number of instances of clear resin pockets, which one would not expect to be present in a moulding of this nature. However, in view of the low magnification and consequent uncertainty anent this point, the formulation of more definite conclusions regarding this will be left for later examination. For the present, the most outstanding features of this illustration lay first in the multi-coloured effect due to the presence of the pigmented fraction in the moulding powder. Thus we find areas of material, such as those marked A, exhibiting the presence of pigment, while surrounding areas are mainly composed of the impregnated portion. It is of interest to note that these pigmented sections of the structure possess sharply defined boundaries, which will be discussed at greater length at a later stage.

Meanwhile, the second point of significance in this photograph is the apparent absence of orientation, or perhaps it would be preferable to say, the small degree of orientation present. This latter would normally be expected to be somewhat greater than that shown, but the structure under this magnification is not clearly enough defined to enable one to say whether orientation exists to any high degree or not, for certain aspects would point to a fairly high state of

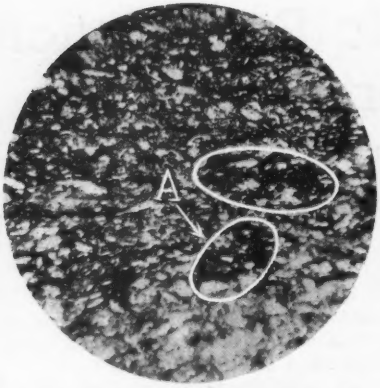


Fig. 353.—Transverse section of wood flour filled moulding: general view. Mag. 26 diameters.

Fig. 354.—General structure of wood flour filled moulding as seen under polarized light, system crossed. Mag. 26 diameters.

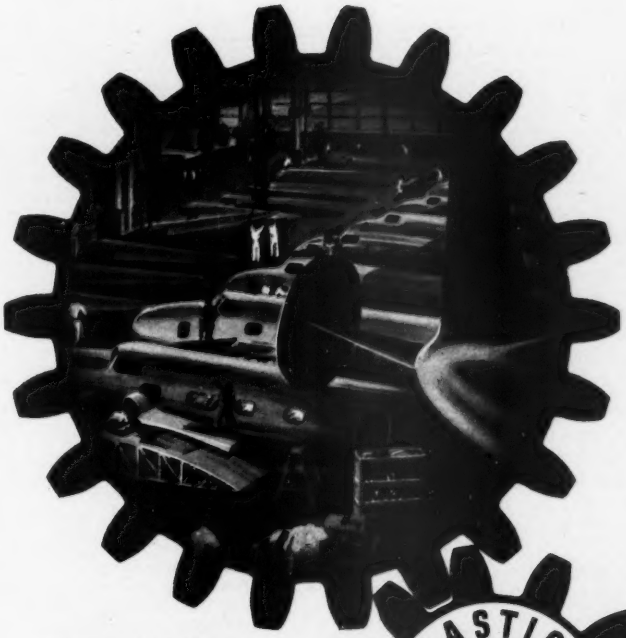
orientation, while others would tend to mitigate this conclusion. However, in general, there appear to be definite indications towards a tendency for the filler particles to orientate themselves in a horizontal direction.

This assumption requires confirmation, which is best obtained by the use of polarized light, for it has previously been demonstrated ("Plastics," December, 1948) that in a crossed polarized system, the filler (if birefringent) will be differentiated from the matrix of resin, which will not exhibit birefringence unless under a condition of stress, and as this seldom, if ever, exists in a thin section of this nature, the filler particles only will be visible. In this way the general structure of this material is made clear, in so far as the wood flour is concerned, in Fig. 354, which shows a portion of the section at 26 diameters under the aforementioned conditions of illumination.

The filler particles here are seen to stand out very clearly, thus showing their positions in the structure relative to themselves and to the structure in general, and from which it is plain that there exists a strong tendency to horizontal orientation and layer formation, as evidenced by the position of the wood flour particles in the areas marked A and B. Although the tendency for horizontal orientation is undoubtedly present, the degree of orientation exhibited is not so great as one would expect in the circumstances, particularly in view of the morphology of the filler particles, which are seen to be generally some four or five times as long as they are broad, examples of which include the particles marked C, which are seen to lay at various angles to the horizontal in spite of their length.

At present the reason for this is not defined clearly enough to enable the expression of an opinion, the only point of significance being the existence of the two layers (A and B) wherein orientation may be said to exist. The two layers, however, are clearly defined, which leads one to the formulation of a tentative conclusion as to the possibilities of the central area D, and the two outer areas, wherein the signs of orientation are very meagre, and function in some way as a result of which channel formation occurs in A and B.

With regard to the filler in general, this photograph shows it to consist of a mixture of particle sizes, which extend from that of the very small units (almost to be considered as extraneous dust) to the large particles (such as those seen at C). It is also clear that the filler has



Mouldings and moulding powders. Resins solid, powdered or in solution. Insulating varnishes. Cements and lacquers. Anti-friction resins for fabric bearings. Casting resins. Capping cements. Paint resins. Filling compounds. Sealing fluids.

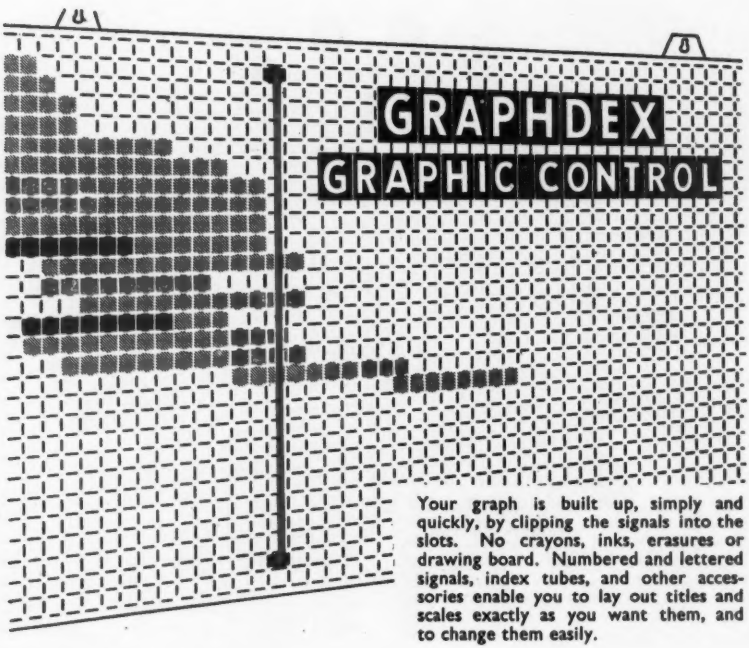
PLASTICS ELO PRODUCTS

In mesh

with today's requirements for the

AIRCRAFT INDUSTRY

Full information and data from Sales Development Department
Birkbys Ltd., Liversedge, Yorkshire, England
London Office : 79, Baker Street, W.1



Your graph is built up, simply and quickly, by clipping the signals into the slots. No crayons, inks, erasures or drawing board. Numbered and lettered signals, index tubes, and other accessories enable you to lay out titles and scales exactly as you want them, and to change them easily.

Every detail of a complicated situation readable *at a glance*, in correct relation ! Effective, up-to-the-minute control with a *minimum* of clerical effort ! These are the advantages you gain when you mechanise your graphs on Remington Rand Graphdex panels.

The ease and simplicity of Graphdex enable you to apply graphic control, with great advantage, to any department of your business : Stock, Materials, Production, Sales, Budgets, can all be controlled more closely, more easily, by this modern method.

A new folder, just published, shows you exactly how Graphdex Charts work : why not write for a copy ?

Remington Rand

REMINGTON RAND LTD., Dept. 26, Commonwealth House, 1 New Oxford Street, London, W.C.1
Telephone : CHAncery 8888

Sales Offices and Service Depots throughout Great Britain

Fig. 355.—Section of wood flour-filled moulding showing differentiation of two-part powder. Mag. 26 diameters.

suffered little in the way of subsequent reduction in particle size occurring in the processing of the moulding powder, as was shown during the examination of the moulding filled with the mixture of wood flour and coconut-shell flour. It might be pointed out at this stage that the structure of this moulding offers confirmatory evidence regarding the conclusions arrived at during the discussion of the behaviour of the mixed filler.

In general the filler seen in the moulding at present under examination is typical of the softwood filler as used extensively at present in this country and which has been previously discussed in this work. The behaviour of this material when used as a filler is of interest, particularly in mouldings of the type under examination which are made from a mixed powder. In view of the apparent segregation seen in the portion of the section just discussed, it is expedient to examine the section in further detail, in order to elicit information regarding the behaviour of the two parts of the moulding powder.

Fig. 355 shows another portion of the same section, photographed by transmitted light, at a magnification of 26 diameters. The structure seen in this illustration is interesting and significant, as the whole area in view is seen to consist of clearly defined portions of each fraction of the powder. For example, the field is bisected along the line AA by the presence of a mass of pigmented material. The line of demarcation is quite definite; there is no dubiety as to where one ceases and the other begins. However, the more interesting structure is seen at B, where the presence of a smaller mass of pigmented material is evident, situated in the middle of a relatively large mass of the unpigmented fraction.

The centre of this pigmented mass is occupied by a large wood flour particle, while another particle, somewhat smaller in size, is to be seen at D. The presence of these particles is pointed out, as it might be thought that the pigmented mass in question might consist of more than one, whereas in reality it is a single mass, despite the appearance resulting from the presence of the two large filler particles.

The behaviour of this mass is interesting in as much at it will be seen to have been subject to considerable flow in several directions, as indicated by the amoeboid-like processes extending in the directions shown at C. The flow would not seem to be the result of an undirectional force, and neither would it arise from pressure initially acting upon it from all directions simultaneously, such as would be experienced by a body subjected to pressure in a fluid medium, for in this event the mass could be expected to assume a spherical shape. It would, therefore, appear that a configuration such as this is due to a series of changing pressures and viscosity condition occurring during the moulding cycle. Thus it is reasonable to suppose that, due to the presence of the pigment, the viscosity of this mass would be slightly higher than that of the unpigmented portion of the moulding powder.

Under these conditions it commences to move, a little later than the surrounding mass, but if this occurred generally throughout the pigmented mass, then a

Fig. 356.—Transverse section of wood flour-filled moulding, as in Fig. 355, seen under polarized light, system crossed. Mag. 28 diameters.

spherical shape may still be expected. As the shape is very irregular, however, it becomes apparent that softening and subsequent movement of the mass must occur at various positions and at differing times throughout its structure.

Thus the development of the more greatly extorted processes could be attributed to portions of the surface layers of the pigmented mass becoming more fluid at an earlier stage than for those more deeply seated. At the same time the fluidity of the surrounding unpigmented mass must also vary throughout its mass, otherwise the elongated processes could not have been pushed out from the pigmented portion. The occurrence of a more fluid portion in the unpigmented mass would result in the development of a process, such as any of those shown at C. This would continue to occur until movement is arrested by the fluidity of the surrounding mass reaching a state of equilibrium, or general hardening up of the resin.

In order that the structure of this portion of the section may be clarified, examination under polarized light is advantageous. Fig. 356 shows the same portion of the section, at a slightly higher magnification (28 diameters), and under polarized light, with the system crossed.

From this illustration it will be seen that the line of demarcation between the large pigmented mass and the unpigmented area is not as sharply defined as in the previous illustration, due to the pigment's being invisible when in a cross-polarizing system. The only guide to the boundary is that furnished by the relative disposition of the filler particles in the two areas under consideration. This boundary is shown at the dotted line AA. If we consider the structure of the large pigmented area, that is to say, the area above the line AA, it will be noticed that the filler particles exhibit definite tendencies towards horizontal orientation, which also serves to differentiate the boundary between the two areas. This orientation, however, is not very marked and it would appear that turbulence within the structure of the pigmented mass did not occur to any great extent.

The point of greatest interest in this illustration, however, is indicated by the structure of the smaller pigmented area, as seen under polarized light. The behaviour of the filler particles in this instance is clearly shown under these lighting conditions. The actual mass itself is outlined, and it will be readily appreciated that the flow in the processes of the mass, as seen at C, must have been fairly considerable, as the orientation of the particles is more marked in this instance; in fact, their behaviour as depicted is self-explanatory. One interesting feature is brought to light by the use of the polarizing system, that is, the structure of the large filler particle at B is now seen to be composed of a group of somewhat smaller particles, instead of one large one, as was assumed to be the case when discussing the appearance presented under standard lighting conditions.

The whole structure of the smaller pigmented area suggests that it behaves as if it were a large individual particle situated in a matrix of the unpigmented material. Thus the line of demarcation of the large pigmented area may be regarded as the mould face, in which event it will be seen that the flow effects

Fig. 357.—Transverse section of wood flour-filled moulding. Mag. 26 diameters.

in the unpigmented material are typical of those exhibited in cases where large filler particles are met with. In this instance, however, there also exists flow patterns in the body of the large particle, which may be more or less disregarded when considering the behaviour of the small pigmented mass as a whole, although in view of the nature of the mass and its surrounding matrix, there is little doubt that there must be a certain degree of mutual interaction which will determine the alternate morphology of the smaller pigmented mass.

This assumption suggests the development of interesting speculation regarding the general behaviour of mixed moulding powders such as that under construction, and in view of this it is expedient to examine the structure of this moulding in a little more detail. It will be appreciated that the behaviour inevitably will be somewhat complex, due to the presence of the wood flour particles in the first instance, and the granules of the harder portion of the powder in the second instance. The manner in which the two fractions of the powder retain their individuality in spite of the moulding conditions has already been demonstrated in Figs. 355 and 356.

In Fig. 357 is seen a further example of this at another portion of the section. The magnification in this case is again 26 diameters. The photomicrograph shows a large pigmented granule B, whose inner border is indicated by the dotted line AA, and which is situated at the surface of the moulding (the edge of the section, however, is not shown in the photograph). Slightly below this particle lies a smaller one of the same type. The outline of this particular unit is indicated by the dotted line DD. It is clear from this that the structure shown may be regarded as portraying the behaviour of one very large particle B, and a nearby smaller particle in a matrix of the unpigmented material.

At the outset, it is also clearly evident that the particles themselves exhibit a certain amount of flow, which is, of course, to be expected. Thus, in this respect, the behaviour of these particles exhibits a fundamental difference from that of a normal filler particle, which is not usually of a plastic nature. However, the flow seen in these pigmented particles is considerably less than that of the unpigmented portion of the powder. In these circumstances, the conditions encountered during moulding might be expected to produce a greater degree of fusion intermingling of the two materials than does actually exist; in fact, the sharp delineation of the fractions one from the other indicates that little, if any, fusion takes place.

However, although we have so far regarded the pigmented granules as being large particles in a matrix of unpigmented material, the possibility of the two fractions possessing equal flow—which might be adjusted in the initial stages of manufacture of the powder—must not be overlooked, but if this were so, greater evidence of fusion of the two fractions might be expected.

As the characteristic signs of channel formation are seen to be present in the area between the two dotted lines, and as this occurs in the unpigmented material, it is reasonable to suppose that this latter behaves more as the matrix than the pigmented material. The flow effects produced in the matrix material are

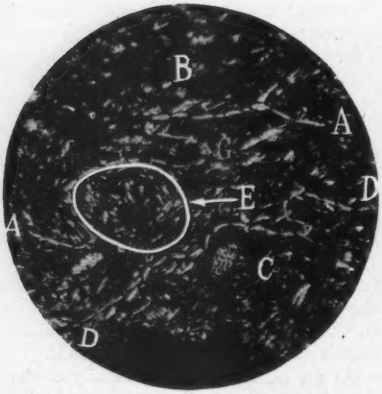


Fig. 358.—Section of wood flour-filled moulding, seen under polarized light, system crossed. Mag. 26 diameters.

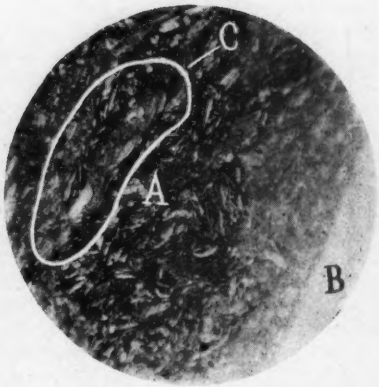


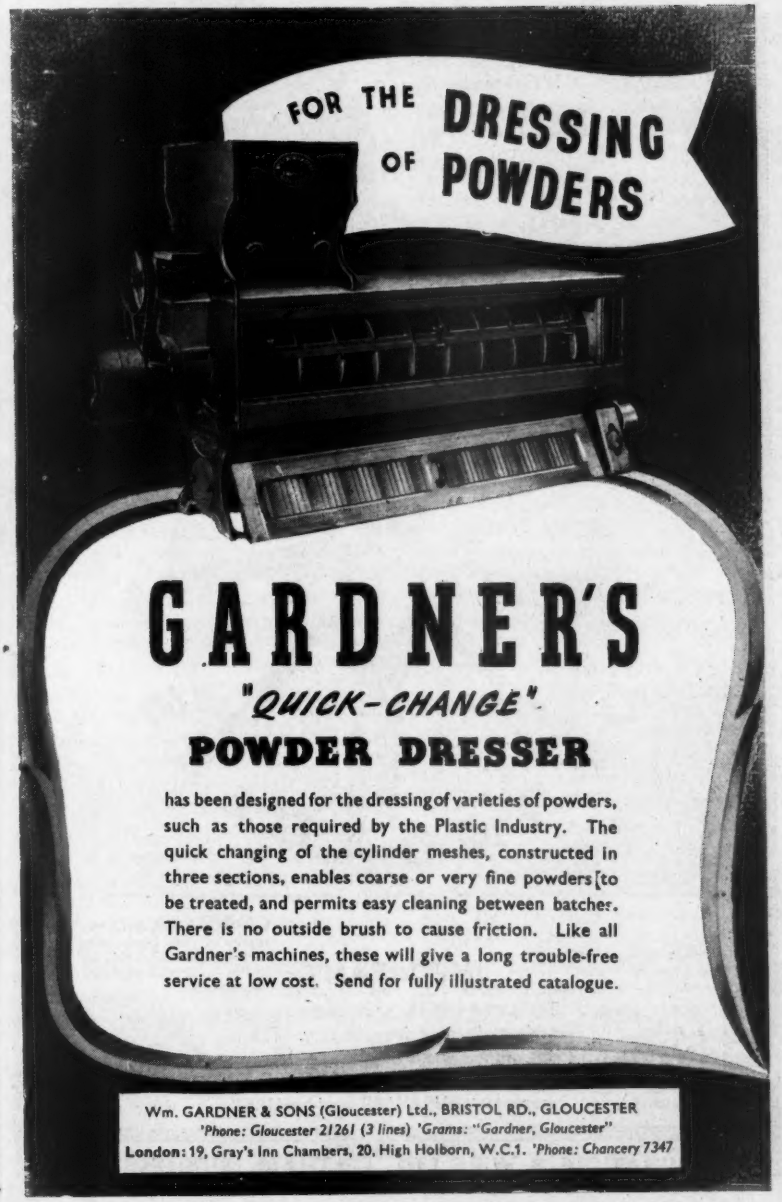
Fig. 359.—Section of wood flour-filled moulding showing behaviour of secondary particles. Mag. 26 diameters.

interesting, as they are not so straightforward as in those cases when channel formation is brought about by filler particles only. In this case consideration has to be given to the effects produced by the alteration in shape of the particles producing the channel, i.e., the pigmented granules. Thus it will be seen that turbulence in the channel has produced a whorl-like structure enclosed in the area E, which is probably the result of the belated development of the extended process producing a resistance to the flow of the material. This is indicated by the position of this process, which can be assumed to have originally developed in a downward direction and while still soft to have been pushed over to one side by the stream of matrix material, which presumably flowed from left to right.

The general behaviour of the filler particles under these conditions is seen in Fig. 358, which is the same portion of the section photographed under polarized light. This illustration is annotated in the same manner as that previously discussed, the line AA indicating the boundary of the large pigmented area, while DD delineates the smaller area and E is the whorl-like structure in the matrix material. The orientation of the filler particles clearly shows the nature of the flow in the channel and the interruption or blocking brought about by the development of the process G, which presumably led to the turbulence resulting in the whorl structure.

An interesting point regarding the general structure of the section at this place gives rise to speculation regarding the relative times at which the pigmented and unpigmented portions become immobile, for it is clear that if, indeed, the development and subsequent fixation of the process G occurred as suggested, then the matrix material in the channel must have been in a fairly fluid condition and still moving for an appreciable time afterwards, otherwise the turbulence seen would not have had time to arrive at the state illustrated. This would appear to indicate that there was a not inconsiderable difference in the times taken for the two functions of the moulding powder to reach a state of immobility, which condition would tend to help the one to behave as a filler in a matrix, resulting in the pigmented material being sharply delineated against the unpigmented as demonstrated.

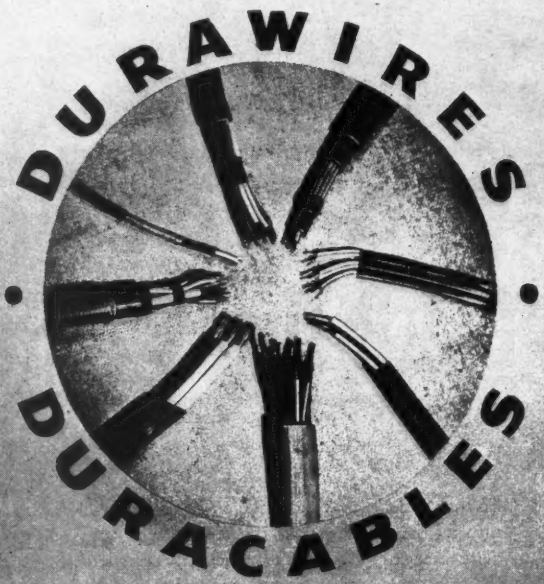
In view of this and for purposes of further consideration of the material, it is permissible to regard the moulding as


FOR THE DRESSING OF POWDERS
GARDNER'S
"QUICK-CHANGE"
POWDER DRESSER
has been designed for the dressing of varieties of powders, such as those required by the Plastic Industry. The quick changing of the cylinder meshes, constructed in three sections, enables coarse or very fine powders to be treated, and permits easy cleaning between batches. There is no outside brush to cause friction. Like all Gardner's machines, these will give a long trouble-free service at low cost. Send for fully illustrated catalogue.
Wm. GARDNER & SONS (Gloucester) Ltd., BRISTOL RD., GLOUCESTER
'Phone: Gloucester 21261 (3 lines) 'Grams: "Gardner, Gloucester"
London: 19, Gray's Inn Chambers, 20, High Holborn, W.C.1. 'Phone: Chancery 7347

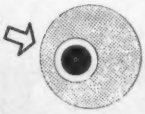
P.V.C. INSULATED WIRES & CABLES

Oil-Proof
Petrol-Proof
Non-Ageing
Non-Inflammable

"S" Duratwinflex
"S" Durathreeflex
"SS" Duratwinflat
"SS" Durathreeflat
"SS" Duratwincable
"SS" Durathreecable
"SS" Durafourcable



SEE *the danger point when extrusion is imperfect.*



IMPORTANT

The pattern of the cross-section of any cable made by us does not vary. This is one of the reasons why leading electrical engineers insist on our products and why we repeat "DURAWIRE...and be SURE."

COMPARE *with the safety of this Duracable section where the P.V.C. insulation has been extruded with high accuracy.*

SOLE MANUFACTURERS
DURATUBE & WIRE LTD., FELTHAM, MIDDLESEX

Fig. 360.—Same portion of wood flour-filled moulding as in Fig. 359, seen under polarized light, system crossed. Mag. 32 diameters.

consisting in the first instance of a resin and wood flour system, in which the wood particles may be regarded as primary units, and these particles or granules, which make up the pigmented portion of the moulding powder, are looked upon as secondary particles of a complex nature, containing also a proportion of primary particles similar to that existing in the matrix material. When looked at from this aspect, the behaviour of individual secondary particles is interesting, inasmuch as their formation would appear to aid the development of an homogeneous structure. Thus in Fig. 359, illustrating a secondary particle at 26 diameters, it is evident that A has flowed to an appreciable extent, the significant feature being that the unit is situated at the surface of the moulding B.

The discussion of the previous two illustrations revealed that, though the secondary particle examined exhibited indications of morphological distortion due to flow, this latter is seen to be somewhat less than in the present case; the reason would appear to lie in size of these secondary units, that previously examined being much larger and although situated at the surface of the moulding, it is probable that its mass was responsible for a certain amount of restriction of fluidity, due to less rapid heating of the structure. In the particle under examination, however, it is obvious that the mass is considerably less. Further, being situated so near to the mould surfaces, the heating may be expected to be much more rapid, in consequence of which the material would develop a higher degree of fluidity, although the time taken for the mass to set completely would be less.

This extra fluidity in the smaller secondary particles has the effect of eliminating blocking at the surface, which, it will be remembered, occurred profusely where large inflexible filler particles existed in a moulding. This propensity to "smooth things out," as it were, is well shown in the illustration under discussion, where the fluid nature of the particle can clearly be seen to have resulted in a considerable alteration of the shape of the unit as a whole, under the influence of the focus encountered. This is also evidenced by the shape of the particles in general, and the nature of the extended processes in particular, the most outstanding example of the latter being the re-entrant process seen at C.

The behaviour of the primary particles in these circumstances is interesting, for when the section is examined under a crossed polarizing system, these are seen to exhibit signs of behaving in a somewhat independent manner when situated in a secondary particle.

In Fig. 360, where the same particle is seen at a magnification of 32 diameters, under the aforementioned lighting conditions, this same particle has been outlined in order to clarify the picture. The primary particles within this boundary are seen to behave as if the secondary particle were a separate little moulding, and the orientation patterns and general positioning of the primary particles, particularly in the extended processes, are such as would be expected if it were possible to make a moulding of the size and shape of the particle in question.

(To be continued.)

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2. price 1/- each.

B.P. 605,218. Appl. 18.12.45. Conv. (U.S.A.) 23.12.44. Acc. 19.7.48.
Silicone Resin Compositions. To: The British Thomson-Houston Co., Ltd.

Preparation of an elastic, cold flowing composition by mixing a dimethyl silicone oil with boric acid or a borate, heating the mixture and subjecting it to the catalytic action of benzoyl peroxide, titanium dioxide or ferric chloride.

B.P. 605,338. Appl. 26.9.45. Conv. (U.S.A.) 29.9.44. Acc. 21.7.48.
Method and Apparatus for Electrostatically Coating Articles. H. J. Ransburg, H. G. Ransburg, H. P. Ransburg and E. M. Ransburg. To: Harper J. Ransburg.

B.P. 605,357. Appl. 20.12.45. (Addition to B.P. 588,751.) Acc. 21.7.48.
Production of Cellulose Ethers. J. H. Macgregor. To: Courtaulds, Ltd.

Refers to acetone-soluble cynoethyl cellulose ethers.

B.P. 605,381. Appl. 20.12.45. Conv. (U.S.A.) 27.12.44. Acc. 22.7.48.
Thermoplastic Compositions. To: British Celanese, Ltd.

Stabilization of cellulose acetate with calcium lactate.

B.P. 605,411. Appl. 21.12.45. Conv. (U.S.A.) 21.12.44, 30.11.45. Acc. 22.7.48.
Cellulose Derivative Compositions. To: British Celanese, Ltd.

Stabilization of cellulose ethers by compounding the latter with a plasticiser in which sulphur dioxide has been dissolved.

B.P. 605,413. Appl. 21.12.45. Conv. (U.S.A.) 21.12.44. Acc. 22.7.45.
Cellulose Ether Compositions. To: British Celanese, Ltd.

Cellulose ether moulding composition stabilized with citric acid, mono-ethyl citrate or diethylcitrate.

B.P. 605,417. Appl. 21.12.45. Acc. 22.7.48.
Manufacture of Resinous Condensation Products. A. Brookes and F. L. Hudson. To: British Industrial Plastics, Ltd.

B.P. 605,441. Appl. 11.5.44. Conv. (U.S.A.) 13.4.43. Acc. 23.7.48.
Silicate Plastics and Methods of Preparing them. To: Haveg Corporation.

Moulded articles produced by mixing a solution of sodium silicate (not less than 45 per cent. conc.) having a $Na_2O : SiO_2$ ratio of 1 or more to 2.4 and sufficient sodium silicofluoride to effect neutralization, forming the articles from the plastic dough and hardening them by the application of heat.

B.P. 605,445. Appl. 17.11.44. Conv. (U.S.A.) 18.11.43. Acc. 23.7.48.
Polymeric Materials. To: E. I. Du Pont de Nemours and Co.

Refers to vinyl fluoride polymers.

B.P. 605,516. Appl. 27.12.45. Conv. (Netherlands) 4.11.44. Acc. 26.7.48.
Emulsion Polymerization of Vinyl Halides. To: N.V. De Bataafsche Petroleum Maatschappij.

B.P. 605,517. Appl. 27.12.45. Conv. (Netherlands) 23.3.44. Acc. 27.7.48.
Manufacture of Co-polymerization Products. To: N.V. De Bataafsche Petroleum Maatschappij.

Copolymers of vinyl halides with vinylidene halides and with acrylic or methacrylic compounds.

B.P. 605,535. Appl. 28.12.45. Conv. (U.S.A.) 18.12.44. Acc. 26.7.48.
Bonding Rubber and Synthetic Rubber to Metals. J. R. Rafter. To: The Firestone Tire and Rubber Co.

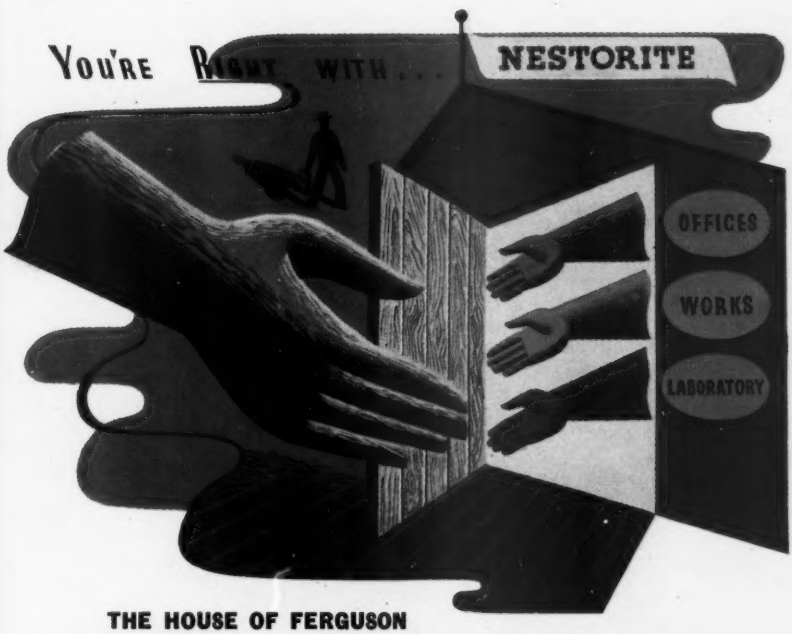
Bonding of rubber to light metals by treatment of the metal surface with an acidified polyhydric alcohol, drying the surface and adhering the rubber by means of conventional rubber-to-metal adhesives.

B.P. 605,594. Appl. 31.12.45. Conv. (U.S.A.) 29.12.44. Acc. 27.7.48.
Mounting Means for Plastic Panels. To: Ford Motor Co.

B.P. 605,597. Appl. 31.12.45. Acc. 27.7.48.
Synthetic Resinous Moulding Compositions. H. Weber.

Moulding powder comprising a thermosetting resin, proteins (soya bean, casein, etc.), aluminium dross, an amine, fillers, pigments and sodium silicate.

B.P. 605,606. Appl. 31.12.45. Conv. (Netherlands) 1.3.43. Acc. 27.7.48.
Manufacture of Polymerization Products



THE HOUSE OF FERGUSON

There are two types of Business Firms in the World. The one where you endeavour to explain your requirements to a cold and impersonal organisation—the other where you immediately make contact with friendly human beings who are immediately responsive, and welcome you as a newly-made friend—rather than a "mere enquirer," or a potential customer.

The whole Tradition of the House of Ferguson is based upon the personal touch. It pervades our Works, our Laboratories, our offices, and binds our customers to us all in personal friendship.

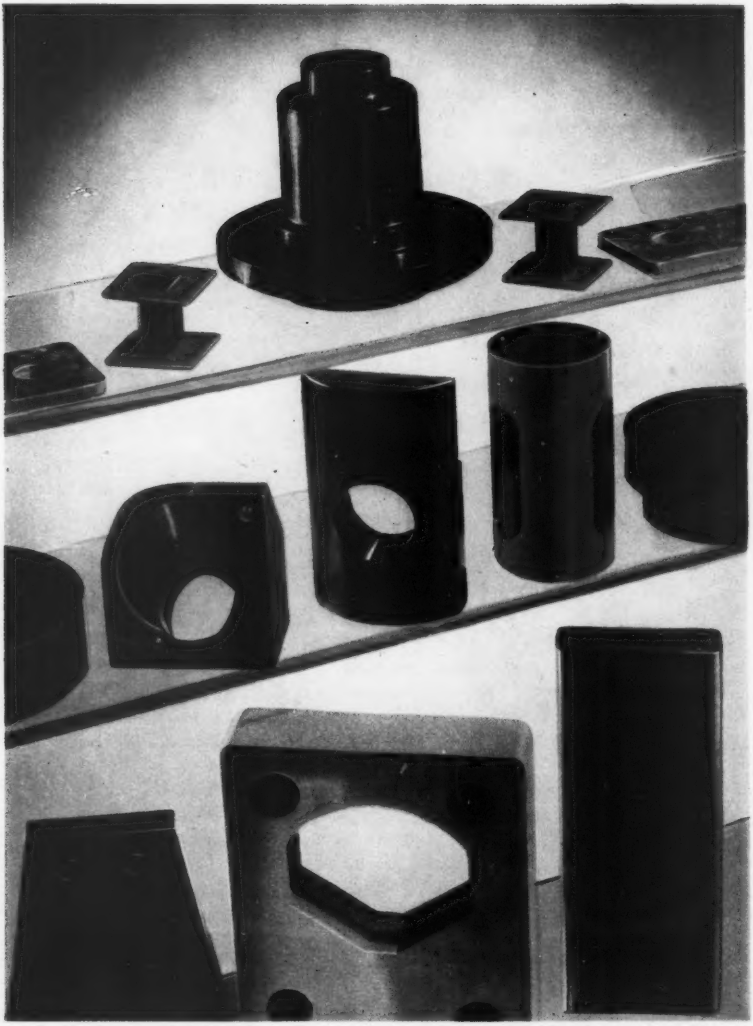
What an ideal in Business—and what an ideal for the disunited World of To-day!

It is perfectly feasible—for we've tried it and PROVED it—with most successful results.

JAMES FERGUSON & SONS LTD.

MERTON ABBEY LONDON S.W.19. Tel: MITCHAM 2283-7

A. S. HARRISON & CO. Pty. Ltd., 85, Clarence Street, Sydney, Australia.
ANDRE BERJONNEAU, Boulevard des Batignalles, 33, Paris (Ville), France.
JOSE DELCLOS, Gignas, 36, Barcelona (2), Spain.
EINAR HOLMARK, 19, Gt. Kongevei, Copenhagen V., Denmark.



m and i

THE MICANITE & INSULATORS CO. LTD.

Empire Works, Blackhorse Lane, Walthamstow, London, E.17

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS and TERMINALS. Distributors of Micoflex-Duratube Sleevings and Micoflex-Durasleeve (Plastics-covered flexible metal conduit)

from Vinyl Chloride. To: N. V. De Bataafsche Petroleum Maatschappij.

Refers to the polymerization of vinyl chloride obtained by pyrolysis of pure dichloroethane.

B.P. 605,626. Appl. 1.1.46. Acc. 28.7.48.
Manufacture of Combs by Injection Moulding. E. H. Brant.

B.P. 605,643. Appl. 1.1.46. Acc. 28.7.48.
Processes of Ornamenting a Surface of an Article formed from Thermosetting Plastic. G. F. Bassett and C. Lomas. To: Ashdowns, Ltd.

B.P. 605,651. Appl. 2.1.46. Acc. 28.7.48.
Coating of Surfaces with Compositions comprising Synthetic Resins. W. E. F. Gates. To: Imperial Chemical Industries, Ltd.

Coating of surfaces with synthetic resin compositions (polyvinyl chloride paste) by spraying the paste admixed with a stream of hot gas on the surfaces to be coated (the hot gas causes gellation).

B.P. 605,655. Appl. 2.1.46. Acc. 28.7.48.
Heating of Dielectric Materials by High Frequency Electromagnetic Waves. J. Dyson and R. Keitley. To: British Thomson Houston Co., Ltd.

Method of heating insulating materials by H.F. energy. The insulating material is located in a wave guide to which the energy is supplied. The insulating material is disposed in the guide in such a way as to form an effective load absorbing the whole of the energy supplied to the guide.

B.P. 605,677. Appl. 3.1.46. Acc. 28.7.48.
Injection Moulding Machine. R. H. Bell and L. N. Jones. To: Alfred Herbert, Ltd.

Refers to injection moulding machines in which the main die-clossing ram acts in a vertical direction.

B.P. 605,688. Appl. 3.1.46. Acc. 28.7.48.
Jointing of Metal Inserts to Thermoplastic Articles. R. Gray. To: Chloride Electrical Storage Co., Ltd.

B.P. 605,702. Appl. 12.1.45. Conv. (U.S.A.) 22.1.44. Acc. 29.7.48.
Heat Sealable Sheet Material and Container, and Method of Making Same. To: Marathon Corp.

B.P. 605,706. Appl. 26.3.45. Conv. (U.S.A.) 1.4.44. Acc. 29.7.48.
Resinous Compositions. To: Westinghouse Electric International Co.

Liquid composition capable of being completely polymerized into a thermoset resin, comprising the reaction product of a non-frosting mixture of oils (castor oil and linseed oil) maleic anhydride and a solvent (mono-styrene).

B.P. 605,729. Appl. 5.11.45. Acc. 29.7.48.
Seam Welding or Seam Bonding. J. W. Dalgleish. To: Pye, Ltd.

Seam welding or bonding by supplying electric power to a welding or bonding wheel in pulses, controlling the pulse repetition rate directly in accordance with the speed of rotation of the wheel.

B.P. 605,766. Appl. 4.1.46, 1.2.46. Acc. 29.7.48.
Process for Embossing Polyvinyl Chloride Coated Sheet Material. W. L. Brogan. To: Imperial Chemical Industries, Ltd.

B.P. 605,767. Appl. 4.1.46. Conv. (U.S.A.) 4.1.45. Acc. 29.7.48.
Shaped Polyamide Products. To: Imperial Chemical Industries, Ltd.

B.P. 605,768. Appl. 4.1.46. Conv. (U.S.A.) 4.1.45. Acc. 29.7.48.
Resinous Condensation Products. To: E. I. Du Pont de Nemours and Co.

Production of laminated objects (plywood) comprising the bonding of wood laminæ by hot pressing. The bonding medium comprises the reaction product of hexamethylene diamine and carbon disulphide with formaldehyde.

B.P. 605,770. Appl. 18.2.46. Acc. 29.7.48.
Removal of Colour from Shaped Articles Comprising a Polymer or Copolymer of Acrylonitrile. J. C. Richards. To: E. I. Du Pont de Nemours and Co.

B.P. 605,771. Appl. 18.2.46. Acc. 29.7.48.
Removing of Colour from Shaped Articles comprising a Polymer or Copolymer of Acrylonitrile. R. A. Schneiderbauer. To: E. I. Du Pont de Nemours and Co.

B.P. 605,806. Appl. 5.1.46. Acc. 30.7.48.
Heating and Manufacture of Sheet Material from Comminuted Material with a Plastic Bond. W. J. Shrimpton. To: British Artificial Resin Co., Ltd.

Manufacture of sheets from sawdust, etc., with which there is incorporated a plastic bond by feeding a layer of the material on to a moving conveyor preferably together with a flexible support passing the material through an H.F. field subsequently consolidating the material by heat and pressure.

B.P. 605,820. Appl. 16.12.46. Acc. 30.7.48.
Moulding of Articles made of or comprising Synthetic Resins. K. W. Mieszkis.

Method of moulding synthetic resins using an alloy with a melting point below the moulding temperature as pressure medium.

B.P. 605,826. Appl. 7.1.46. Acc. 30.7.48.
Production and use of Alkali Alginate Solutions. E. E. Tallis. To: Courtaulds, Ltd.

Aqueous alkali alginate solution suitable for the extrusion of threads containing 0.01 to 0.1 per cent. of a cation active compound.

B.P. 605,859. Appl. 13.10.43. Acc. 3.8.48.
Film Forming Composition. To: Stein, Hall and Co., Inc.

Method of treating articles to render them waterproof by applying at least one film-forming substance (natural gum, polyvinyl alcohol or an amylaceous substance) and a water-soluble pyroantimonate, dehydrating the film-forming substance afterwards at a pH less than 10.

B.P. 605,899. Appl. 19.12.45, 15.7.46, 15.8.46. Acc. 3.8.48.
Method of Sealing Wrappers. V. P. Harvey. To: Molins Machine Co., Ltd.

Refers to heat sealing equipment for cellulosic wrappers.

B.P. 605,929. Appl. 2.9.46 (Addition to B.P. 573,809). Acc. 3.8.48.
Manufacture of Interpolymers of Styrene with Polyhydric Alcoholic Mixed Esters and of Coating Compositions obtained therefrom. L. E. Wakeford, D. H. Hewitt, F. Armitage and H. Steiner. To: Lewis Berger and Sons, Ltd.

B.P. 605,960. Appl. 17.10.45. Acc. 4.8.48.
Insecticidal Coating Compositions. D. H. Hewitt, L. A. Paxon and J. Roseman. To: Lewis Berger and Sons, Ltd.

Insecticidal coating compositions containing a film-forming constituent (copolymer of styrene with a drying oil or a vinyl polymer), dichlorodiphenyl trichloroethane, fillers, solvents and driers (naphthenates).

B.P. 605,972. Appl. 1.1.47. Acc. 4.8.48.
Plastic Material. L. Finkelstein.

Plastic material hardening on exposure to air consisting of 50-60 per cent. solid polyvinyl acetate emulsion, 34-45 per cent. precipitated whiting and 2-4 per cent. glycerine.

B.P. 605,978. Appl. 7.1.46. Acc. 4.8.48.
Insert Moulding. A. C. Barlow and J. M. Griffith. To: Fairey Aviation Co., Ltd.

B.P. 606,045. Appl. 9.1.46. Conv. (Belgium) 18.1.45. Acc. 5.8.48.
Casting of Films and Sheets and Coatings formed on Rigid Supports for Use therein. To: Gevaert Photo Producten N.V.

Films and sheets cast upon supports coated wholly with products of glycollic acid ethers of non-sugary polysaccharides and/or their derivatives.

B.P. 606,050. Appl. 9.1.46. Conv. (Sweden) 17.1.45. Acc. 5.8.48.
Production of Vinyl Copolymers. To: Mo Och Domsjö Aktiebolag.

Production of copolymers of vinylidene chloride and vinyl acetate, in the presence of water and methylene chloride, ethylene dichloride or benzene and benzoyl peroxide as catalyst.

B.P. 606,080. Appl. 10.1.46. Conv. (U.S.A.) 1.3.45. Acc. 5.8.48.
Unsaturated Polymeric Materials. To: United States Rubber Co.

Interpolymer of styrene (having the vinyl radical unsubstituted) a monomeric allylic fumarate and a monomeric allylic alcohol.

B.P. 606,085. Appl. 15.3.46. Conv. (U.S.A.) 4.6.45. Acc. 5.8.48.
Trimeric alpha-Methyl Para Methyl Styrene and Method of Making the Same. B. H. Kress. To: Standard Telephones and Cables, Ltd.

B.P. 606,096. Appl. 12.3.41. Conv. (Switzerland) 21.3.40. Acc. 6.8.48.
Manufacture of Methacrylamide. To: Lonza Elektrizitätswerke and Chemische Fabriken A.G.

B.P. 606,097. Appl. 11.4.41. Conv. (France) 15.4.40. Acc. 6.8.48.
Manufacture of Solution of Polyvinyl Chlorides. To: Société des Usines Chimiques Rhône-Poulenc.

Refers to polyvinyl chloride solutions in cyclopentanone.

B.P. 606,099. Appl. 28.10.42. Acc. 6.8.48.
Production of Plastic Compositions containing Polymers or Copolymers of Vinyl Chloride. E. W. M. Fawcett and A. Millien. To: Anglo-Iranian Oil, Ltd.

B.P. 606,116. Appl. 28.5.45. Conv. (France) 31.12.41. Acc. 6.8.48.
Processes for the Polymerization of Vinyl Compounds. To: Soc.été An. des Manufactures des Glaces et Produits Chimiques de St. Gobain.

Refers to the use of trisodium phosphate or lead acetate as stabilizer.

B.P. 606,150. Appl. 12.12.45. Acc. 6.8.48.
Copolymers and Process of Producing them. To: Mathieson Alkali Works.

High molecular weight copolymer prepared from a monomeric mixture containing a conjugated diene component and a mixture of nuclear dichlorostyrenes prepared from ethyl benzene.

B.P. 606,166. Appl. 27.2.46. Conv. 23.10.45 (U.S.A.). Acc. 6.8.48.
Rubber Hydrochloride Film. To: Wingfoot Corporation.
Rubber hydrochloride film plasticized with an ester of oleic acid and dibutyl sebacate.

B.P. 606,169. Appl. 4.3.46. Conv. (U.S.A.) 22.9.43. Acc. 6.8.48.
Moulding Microporous Bodies from Thermosetting Resins. To: National Cash Register Co.

B.P. 606,222. Appl. 10.1.46. Conv. (U.S.A.) 31.1.45. Acc. 10.8.48.
Synthetic Resinous Laminated Articles having Craze Resistant Coatings. D. G. Patterson. To: British Industrial Plastics, Ltd.

B.P. 606,301. Appl. 11.1.46. Acc. 11.8.48.
Preparation of Organo-Silicon Polymers. C. Shaw, W. E. Smith and H. G. Emblem.

B.P. 606,331. Appl. 8.2.45 (Divided out of B.P. 606,259). Acc. 11.8.48.
Injection Moulding Apparatus. D. N. Davies. To: British Resin Products, Ltd.

B.P. 606,364. Appl. 12.1.46. Conv. (U.S.A.) 20.12.44. Acc. 12.8.48.
Polymerization of Vinyl biphenyl. C. E. Barnes. To: General Aniline and Film Corp.

B.P. 606,384. Appl. 14.1.46. Conv. (Switzerland) 15.1.45. Acc. 12.8.48.
Manufacture of Moulded Resins. To: Lonza Electric and Chemical Works, Ltd.
Manufacture of non-combustible and non-inflammable articles from trichloroethyl methacrylate or trichloroethyl acrylate by moulding.

B.P. 604,400. Appl. 14.7.46. Conv. (U.S.A.) 29.3.45. Acc. 12.8.48.
Halogenated Polymers and Methods of Preparing the same. S. D. Kaganoff. To: Standard Telephones and Cables, Ltd.
Chlorination or Bromination of polystyrene by dissolving it in liquid chlorine or bromine.

B.P. 606,416. Appl. 1.3.44. Acc. 13.8.48.
Production of Plastic Compositions. E. W. M. Fawcett and E. S. Narracott. To: Anglo-Iranian Oil Co., Ltd.

Relates to plasticized vinyl chloride polymers and copolymers.

B.P. 606,464. Appl. 15.1.46. Conv. (U.S.A.) 31.1.45. Acc. 13.8.48.
Plastic Clothes Pins. M. Maccaferri.

B.P. 606,567. Appl. 20.7.45. Acc. 17.8.48.
Drying Material in Vacuo by High Frequency Dielectric Heating. E. C. Stanley. To: Communications Patents, Ltd.

B.P. 606,649. Appl. 8.3.44. Acc. 18.8.48.
Shaping Thermosetting Sheet Material. To: North American Aviation Inc.
Shaping of C-stage thermosetting sheets by heating them to a temperature of between 250 degrees F. and 350 degrees F., and shaping the material whilst in a plastic condition, subsequently allowing the sheets to cool.

B.P. 606,661. Appl. 5.4.45. Conv. (France) 9.4.42, 10.11.42. Acc. 18.8.48.
Production of Resins from Phenolic Mixtures. To: Enterprise Albert Cochery.

B.P. 606,685. Appl. 15.10.45. Acc. 18.8.48.
Production of Polymerizable Materials. R. Hammond and J. W. C. Crawford.
Refers to the use of polyhydric phenol sulphonic acids (resorcinol sulphonic acid) as an inhibitor.

B.P. 606,697. Appl. 26.11.45. Conv. (U.S.A.) 8.1.45. Acc. 18.8.48.
Production of Resin-coated Articles. To W. Evans and E. C. Shokal. To: Shell Development Co.

B.P. 606,711. Appl. 4.1.46. Acc. 18.8.48.
Preparation of Solid Pieces of Fusible Filament forming Polymers. W. Pool. To: British Celanese, Ltd.

The following specifications were omitted from their correct sequence, having only recently been published.

B.P. 603,402. Appl. 19.10.45. Acc. 15.6.48.
Production of Light Density Polymeric Materials. To: Expanded Rubber Co., Ltd.
Refers to the production of closed cell expanded polyvinyl acetal (formal) by masticating the resin with a solvent until a dough is formed, incorporating in the dough a modifying agent, subsequently subjecting the dough to gas pressure at elevated temperatures, finally allowing the material to expand and removing the solvent by seasoning.

B.P. 603,425. Appl. 21.10.43. Conv. (U.S.A.) 22.10.42, 28.10.42. Acc. 16.6.48.

Flame-resistant Coating or Impregnating Compositions. R. Loveland. To: Johnson and Johnson (Great Britain), Ltd.

Fireproofing of textile fibres by impregnation with an aqueous dispersion of polyvinyl acetate containing a flame-resistant plasticiser (tricresyl phosphate) and antimony trioxide.

B.P. 604,138. Appl. 5.3.45. Conv. (U.S.A.) 26.2.44. Acc. 29.6.48.

Self-sustaining Flexible Films. R. C. Briant and R. J. Reid. To: The Firestone Tire and Rubber Co.

Self-sustaining flexible film comprising chlorinated rubber or hydrochlorinated rubber, together with an elastomeric copolymer of a conjugated diolefin with an acrylo-nitrile.

B.P. 604,512. Appl. 1.12.44. Acc. 6.7.48.

Production of Coated Sheet Material. To: Imperial Chemical Industries, Ltd.

Manufacture of coated sheets by calendering on to fabric or other sheet material a coating composition based on an organic ester or ether of cellulose or a thermoplastic resin containing a small amount of dibutyl ammonium oleate.

B.P. 604,556. Appl. 27.11.45. Conv. (France) 3.9.41. Acc. 6.7.48.

Manufacture of Hollow Bodies in Synthetic Resin Material. M. J. Maillard.

B.P. 604,567. Appl. 27.11.45. Conv. (U.S.A.) 25.6.43. Acc. 6.7.48.

Apparatus for Coating Articles. H. J. Ransburg, H. G. Ransburg, H. P. Ransburg and E. M. Ransburg.

Refers to the removal of excessive paint or lacquer by passing the article through an electrostatic field.

Index to Advertisers

	Page
Air Mec. Laboratories, Ltd.	xx
Ashdowns, Ltd.	xiii
Axon & Harrison, Ltd.	lii
Bakelite Ltd.	xvii, xxxvi
Banarse, P. S. & Co., (Products), Ltd.	lviii
Barber & Duffy, Ltd.	lx
B.I.P. Tools, Ltd.	xxi
Birkby's Ltd.	xxxix
Booth, J., & Son, Ltd.	lix
Bridge, David, & Co., Ltd.	v
British Cellanese, Ltd.	xvi
British Geon, Ltd.	xxii
British Industrial Plastics, Ltd.	xlv
British Moulded Plastics, Ltd.	xxxvii
British Resin Products, Ltd.	iii
BX Plastics Ltd.	Inside Front Cover
Byson Appliance Co., Ltd.	lviii
Chamberlain & Willows	lii
Cohen, George, Sons & Co., Ltd.	iv
Coldwell, W. B., & Sons, Ltd.	lviii
Cole, E. K., Ltd.	ii
Cole, R. H., & Co., Ltd.	xxxv
Corrugated Packing Material Co., Ltd., The	lvii
Courtaulds, Ltd.	lxiv
Crystalate, Ltd.	xl
Davis & Timmins, Ltd.	lxiv
Desoutter Bros., Ltd.	viii
Dohm, Ltd.	xxxiv
Dufay-Chromex, Ltd.	xxiv
Duraplex (Plastics) Ltd.	xxv
Duratube & Wire, Ltd.	xlii
Electroplant Co., The	lix
English Steel Corporation, Ltd.	xxxi
Erinoid, Ltd.	Back Cover
Evans, Frederick W., Ltd.	lvi
Ferguson, James, & Sons, Ltd.	xliii
Firth, Thos., & John Brown, Ltd.	xii
Flextol Engineering Co., Ltd.	liii
Fox Chemical Engineering Works, Ltd.	li
Fraser, Andrew, Ltd.	xxviii
Gales, Gilbert	liv
Gardner, Wm., & Sons (Gloucester), Ltd.	xli
General Electric Co. Ltd., The	xiv
Gosheron, John, & Co., Ltd.	lvi
G.R.L. Plastics, Ltd.	lvi
Herbert, Alfred, Ltd.	xxiii
Holoplast, Ltd.	xix
Imperial Chemical Industries, Ltd.	Front Cover, xxxviii
Insulators, Ltd.	xlix
Irano Products, Ltd.	xlviii
Jones, E. H. (Machine Tools), Ltd.	lii
Kent Mouldings	xxxiv
Kenure, J. F., Ltd.	xxxii
Kodak, Ltd.	lv
Law, F. W., & Sons, Ltd.	lv
May & Baker, Ltd.	xxix
M.C.L. and Repetition, Ltd.	lviii
Micanite & Insulators Co., Ltd., The	xliv
Monsanto Chemicals Ltd. (Lustron)	xxvi
Moulded Products, Ltd.	ix
Newman Industries, Ltd.	Inside Back Cover
Pascall Engineering Co., Ltd., The	xlviii
Peace, Harold E., & Co., Ltd.	lx
Pitman, Sir Isaac, & Sons, Ltd.	lvi
Penfield & Barstow, Ltd.	liii
Rediffusion, Ltd.	xviii
Reed Bros. (Engineering), Ltd.	l
Reliance Trading Company	lvi
Remington Rand, Ltd.	xl
Richard & Hoskins, Ltd.	lii
Rootes Mouldings, Ltd.	lvii
Rubber Improvement, Ltd.	xv
Runbaken Electrical Products, Ltd.	lx
Sagar (Developments), Ltd.	x
Scott, Bader & Co., Ltd.	xlvii
Shell Chemicals, Ltd.	xxx
Slater, Henry & Leigh	lx
Smith Bros. (Wirewares), Ltd.	l
Steel, John P.	xlviii
Sessels & Cowlishaw, Ltd.	liv
Sterling Moulding Materials, Ltd.	xxxiii
Sternol, Ltd.	li
Sundstrand Pneumatic Sanders (Britain), Ltd.	xxvii
Surridge's Patents, Ltd.	lviii
Telegraph Construction & Maintenance Co., Ltd.	vii
Thorn, J., & Sons, Ltd.	liv
Trapinox, Ltd.	vi
United Ebonite & Lorival, Ltd.	i
United Wire Works, Ltd.	lx
Universal Tools, Ltd.	xlvi
Utilex, Ltd.	xxxii
Vinyl Products, Ltd.	l
Walker, James, & Co., Ltd.	xlvi

Leaves from a Moulder's Notebook

This is the twenty-fifth in a series of notes by B.I.P. Development Department on the problems of the moulder and designer. Nos. 1-12 in this series are already available in booklet form and a second volume which will include this article is being prepared. Comments and enquiries are welcome.

+ or − x°F

It often occurs that a moulding problem involving extraction, shrinkage or even burning can be solved by working the top and bottom tools of a mould at different temperatures.

Any one of these problems may be encountered on a job even of simple proportions and not necessarily on a large complicated moulding, although this is the more likely to require such treatment.

For instance, one such simple job was an internally threaded ring of the type and dimensions shown in Fig. 1 made in the mould shown in Fig. 2. It was possible to produce mouldings within tolerance limits with top and bottom tools both at approximately the same temperature, so long as the temperature was not high and the cure was slightly longer than normal for such a section. An increase in temperature and/or a slight reduction in cure time would effect an increase in diameter of .010 in. to .012 in.

Trial and error showed that a reduction in temperature of the top tool to about 20° F. below that of the bottom tool provided a solution, enabling accurate mouldings to be produced, using the normal cure time.

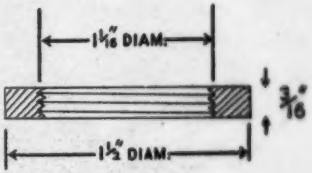


Fig. 1

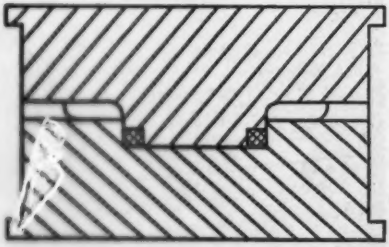


Fig. 2

BRITISH INDUSTRIAL B·I·P GROUP PLASTICS LIMITED

1 Argyll Street, London, W.1

LION
WALKER'S
LION PACKING
MARK
TRADE
THE PACKING & JOINTING
THAT YOU CAN RELY ON
PACKINGS
JOINTINGS
THE James Walker organisation has been serving industry in an ever increasing variety of sealing problems since 1886, so that to-day there is a Walker Packing or Jointing for practically every application in all fields of engineering.
Send to-day for fully illustrated catalogue.
James WALKER & Co., Ltd.
"LION" WORKS, WOKING, SURREY

735

MOULDS BY
UNIVERSAL TOOLS LTD.
TRAMWAY PATH, MITCHAM, SURREY.
TELEPHONE : MITCHAM 1624, 1625, 1626

MARCO RESIN

. . . . . Originally made in America, is now manufactured in this country. It is a thermosetting polyester, which with the help of modern catalysts rapidly polymerises at room temperatures.

It is used for low pressure lamination of paper, felt, fabric and glass cloth.

Exceptionally clear castings, made in the most delicate pastel shades, retain their colour untarnished owing to the low acid value of the resin.

While curing, neither solvent nor condensation products are thrown off. This is of outstanding value to the electrical industry.

SCOTT BADER & CO. LTD.

109 KINGSWAY · LONDON · W.C.2

Telephone: HOLBORN 3691 (3 lines)

HEAD OFFICE & WORKS: WOLLASTON, WELLINGBOROUGH, NORTHAMPTONSHIRE

A Plasticiser

IRANOLIN P.D.L. 18

FOR P.V.C.

Samples and Technical data from

IRANO PRODUCTS LTD
Britannic House, Finsbury Circus
London EC2 *CENtral 7422*

high speed grinding

is just one feature of the

PASCALL

Pin-Disc Mill. Let us demonstrate to you without obligation the capabilities of this versatile mill on your material at our London Test Station.

Write for list P149

THE PASCALL ENGINEERING CO. LTD.
114, LISSON GROVE, LONDON, N.W.1

MOULDS for PLASTICS

by W. M. HALLIDAY

An aid to Toolmakers in the Plastics and Pressure Die-casting Industries dealing with Mould Design, Construction and Maintenance.

Demy 8vo, Illustrated, 30/- net.
(By post 30/6).

Published by English Universities Press for TEMPLE PRESS LTD., Bowling Green Lane, E.C.1.

IMPETUS **BELT GRINDERS or SANDERS** 4" & 6" MODELS

(4" model illustrated) Length 18½", width 7½", length table 12", height 6½", width table 4". Speed 1,400 r.p.m. Back stop adjustable any angle.

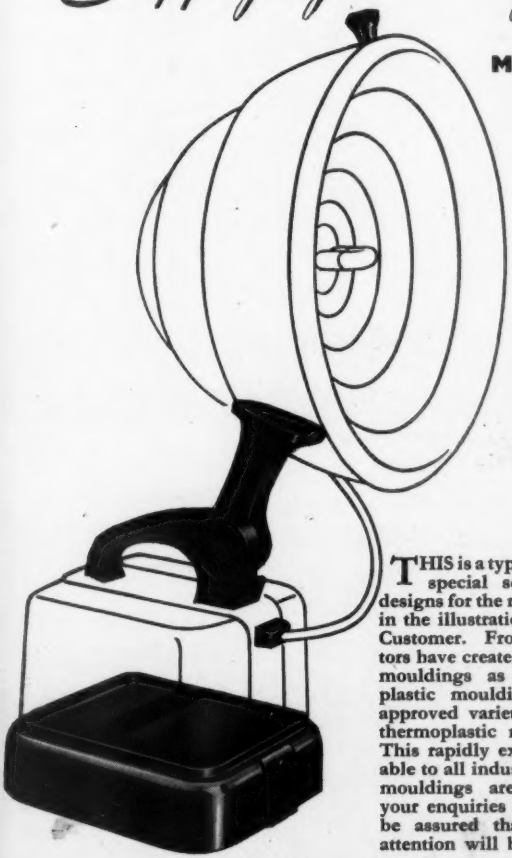
Price £7
Motorised £16

6" model with "Oilite" Bearings, long back-rest, adjustable cross-rest, £16. Motorised £35.

Send for details of other "Impetus" Products. 'Phone: JOHN P. STEEL, Dept. 8, BINGLEY, YKS. 1066 (4 lines)

Supplying Industry's Needs

WITH MODERN METHODS OF MOULDING



By the courtesy of Hanovia Ltd. Sunray lamp, 5 components made in phenolic moulding material using compression and transfer methods.

THIS is a typical example of Insulators' special service to Industry. The designs for the mouldings—shown clearly in the illustration—were supplied by the Customer. From those designs Insulators have created the tools and supply the mouldings as required. All types of plastic mouldings are produced from approved varieties of thermosetting and thermoplastic material.

This rapidly expanding service is available to all industries for which high class mouldings are required. Please send your enquiries to the address below and be assured that specialised individual attention will be given to each enquiry.

Insulators Ltd

Mouldings of Merit

INSULATORS LTD., LEOPOLD ROAD, ANGEL ROAD, EDMONTON, LONDON, N.18
BRANCH FACTORY: JARROW, DURHAM
Telephone: Tottenham 1491 *Telegrams: Mermould, Southtot, London*

MODERN MOULDING PRESSES

RECENTLY PURCHASED
OFFERED FOR *PROMPT DELIVERY*

1,000-ton Moulding Press by John Shaw & Sons (Salford) Ltd., Ram 28" diameter, table 3' 6" x 3'; daylight 3'.

750-ton Downstroke Moulding Press by Greenwood & Batley, table 5' 6" x 2' 9"; daylight 3' 6"; self-contained Pumping Equipment, driven by 18 h.p. A.C. Motor.

700-ton Downstroke Hydraulic Moulding Press by Tangye Ltd., 26" diameter Ram x 40" stroke; table 5' 6" x 4' 8".

350/100-ton Vertical Injection Moulding Press, 18" diameter clamping Ram; 9¼" diameter Injection Ram. 8-10 ozs. capacity per shot.

100-ton Bradley & Turton Upstroke Moulding Press fitted 17" square drilled steel steam platens.

100-ton semi-automatic Downstroke Hydraulic Moulding Press by Rice; 12" diameter Ram x 26" stroke, table 24" square, fitted 18" square steam platens.

Two 75-ton semi-automatic Downstroke Hydraulic Moulding Presses by Rice; Ram 10" diameter, table 15" x 20" fitted with pair of 15" square drilled steel steam platens.

Six 47-ton Angle Moulding Presses, 30-ton Side Rams, 17-ton Downstroke Ram, steam heated platens.

Twelve 10-ton Downstroke Moulding Presses by Hydraulic Engineering Co., fitted 12" x 14" electric platens.

Large Stock of Hydraulic Pumps and Accumulators

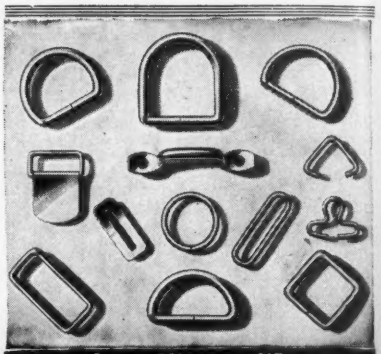
Whatever the **NEED**

Ask **REED BROTHERS (ENGINEERING) LTD.**

BEVIS MARKS HOUSE, LONDON, E.C.3

Phone: *AVEnue 1677/8*
Grams: *REPLANT, ALD, LONDON*

WIRE FITTINGS



PHONE: COLMORE 4617
SMITH BROS. (WIREWARES) LTD.
CLEMENT STREET, BIRMINGHAM, 1.

V.P.

VINYL PRODUCTS LTD.
manufacture

P.V.C. Flexible SHEETING	Synthetic Resin EMULSIONS
'VINATEX' SHEETING In various thicknesses, translucent and opaque, plain colours or printed.	**'VINAMUL' EMULSIONS** For finishing leather, textiles, etc.; for laminated boards and adhesives.
P.V.C. PRINTING INKS	**Polyvinyl Chloride PASTES**
'VINALAK' INKS Printing inks for plastic sheeting, standard colours, light-fast, non-bleeding.	**'VINATEX' PASTES** For coating fabrics, paper, etc.: unpigmented or in standard colours.

Vinyl Products Ltd.
BUTTER HILL • CARSHALTON • SURREY

"YOU WON'T FORGET YOUR
Sternocleanse
AGAIN WILL YOU?"

FREE WORKS POSTERS

like this advertisement will constantly remind your workers of dermatitis dangers. The words "Sternocleanse Posters" written on your note-heading and posted to us will bring you details of STERNOCLEANSE, the anti-dermatitis cream, and its round-the-year Works Poster Scheme.

Your Guard against DERMATITIS—if used ALWAYS

STERNOL LTD • ROYAL LONDON HOUSE • FINSBURY SQUARE • LONDON E.C.2 • HONarch 3871-5

De-flashing Barrel, fully encased.

FOX
for
POLISHING & FINISHING

We specialise in Rumbling Methods and Manufacture of Equipment and Compounds

We welcome enquiries on customers' Polishing and Finishing Problems.
Experimental Plant available.

FOX CHEMICAL-ENGINEERING WORKS LTD.
12, HEATH STREET, LONDON, N.W.3. *Hampstead 3856 (2 lines).*

A COMPLETE
BUTTON MANUFACTURERS' SERVICE..

- "ANGLON" HAND TURNING LATHES
  (Designed by EHJ and built by East Anglian Engineering Co.)
- DUST REMOVAL, HEATING & VENTILATING EQUIPMENT
- "MASTRAL" RUMBLING BARREL UNITS
  (Wood, Metal, Plastic)
- "MASTRAL" POLISHING HEADS
- MOTORISED POLISHING SPINDLES
- POLISHING JIGS
- ALL TYPES OF POLISHING MOPS
- POLISHING COMPOUNDS
- COLLETS

Our Button Manufacturers' Service is being rapidly augmented by the addition of new lines; several interesting machines will be announced shortly. Contact our Button Plant Division for full details of the E.H.J. Service.

E. H. Jones (MACHINE TOOLS) LTD
Colindale 7011 Garrard 1633, 1634 London
EDGWARE ROAD • THE HYDE • LONDON • N.W.9

RICHARD & HOPKINS LTD.

FOR P.V.C. EXTRUDED

PIPING
STRIP
SLEEVING
THONGING

ALSO P.V.C. SHEETING & MATERIALS

31, THEOBALDS ROAD, LONDON, W.C.1
TEL.: HOLBORN 2736-7

NEW PROCESS SELF-ADHESIVE TRANSFERS

For Toys, Rattles, Beakers, Screens, Nursery decoration, Cots, Plastics, etc.

DOLLS' EYES, FLOWERS, PIXIES, SEASIDE CRESTS, GOBLINS, DOGS, NURSERY RHYMES, GALLEONS, ANIMALS, BIRDS, GNOMES, FAIRIES, BUTTERFLIES.

Delivery from Stock. List and samples free.

THE ONLY TRANSFERS WHICH ADHERE PERFECTLY TO CRINOTHENE, POLYTHENE, AND OTHER PLASTICS

P. L. AXON HARRISON,
Jersey, C.I. (Eng.)

VALUATIONS
of
FACTORIES
PLANT & MACHINERY

for Sale, Purchase, Capital Issues, Balance Sheet, Insurance Cover, etc., is a specialised service offered by

CHAMBERLAIN & WILLOWS
Industrial Property Specialists
23, MOORGATE, LONDON, E.C.2
City 6013 (6 lines)

. . . an attractive necessity that encloses the miniature radio set. This is just one of the many injection moulding problems tackled by Punfield and Barstow for the Radio Manufacturer. Yet ALL trades have their moulding problems, so why not get in touch with us? "The more difficult it is—The more we like it!"

QUOTATIONS BY RETURN OF POST

A FEW OF OUR CUSTOMERS :—

Aladdin Industries Ltd.
Champion Electric Corporation.
E. K. Cole Ltd.
Crystal Products Ltd.
Decca Navigator Co. Ltd.
General Electric Co. Ltd.
Lightning Fasteners Ltd.
Newey Bros. Ltd.
Plessey Co. Ltd.
Pye Ltd.
Reeves & Sons Ltd.
Simmonds Aerocessories Ltd.
Slazengers Ltd.
S. Smith & Sons (England) Ltd.
Wilmot - Breeden Ltd.
Yard-o-led Pencil Co. Ltd.

PUNFIELD & BARSTOW

(MOULDINGS) LTD.

BASIL WORKS, WESTMORELAND ROAD, QUEENSBURY, LONDON, N.W.9.

'Phone : Colindale 7160 & 7956 'Grams : Punfibars, Hyde, London

FOR INJECTION MOULDINGS

Flextol

POWER-DRIVEN HAND TOOLS

Regd. Trade Mark

The Flextol N.G.F. 250 Machine and T.C. 250 Tool Kit provide complete equipment for grinding, filing, wire brushing, polishing, etc., and are widely used in the tool rooms of manufacturers of plastic goods.

Write for Pamphlet No. F.31.

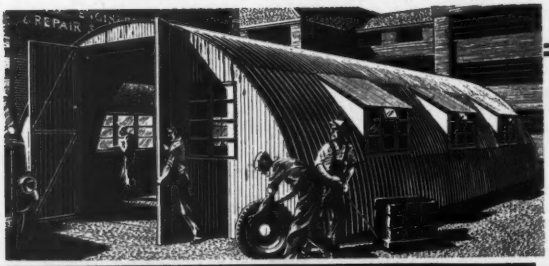
The illustration shows the N.G.F. 250 and T.C. 250 equipment, polishing a two-cavity mould.

Sole Manufacturers and Patentees

FLEXTOL ENGINEERING COMPANY LIMITED

THE GREEN, EALING, LONDON, W.5 'Phones : EAL. 6444/5/6 'Grams : "Dominating", Ealux, London

95.91



SECTIONAL BUILDINGS

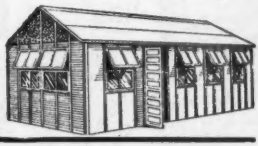
OF UNLICENSED MATERIALS

New and secondhand buildings of all types made in various materials and many sizes. Write, 'phone or call for free illustrated catalogue. Telephone:—Bexleyheath 305

THORNS BOX 30 BRAMPTON RD BEXLEYHEATH, KENT

workshops
stores
garages
offices

A Thorns building to meet every demand. Soundly constructed and easily erected. Prompt despatch.



SUPPLIES FROM STOCK

CASEIN
SHEETS RODS TUBES

CATALIN CAST SYNTHETIC RESIN
SHEETS, RODS, TUBES, PROFILE SHAPES

P.V.C.
Sheeting 48" wide—6/8 thou thick
Also 30-35-40-60 thou thick

CELLULOSE ACETATE SHEET
from 0.05 to 7 m/m. thick
Opaque and Transparent

I.C.I. "CRINOTHENE" in all shades
ACETATE FOR LAMPSHADES—ALL COLOURS

CELLULOID

"PERSPEX" BRAND ACRYLIC RESIN SHEETS
from 1/24" to 1" — Clear and Coloured

EBONITE
SHEETS RODS
MOULDING & INJECTION POWDERS

GILBERT GALEA
MERCHANT IMPORTER-EXPORTER
Established 1918
Dominion House;
Bartholomew Close, London, E.C.1
Phone: MONarch 3994 & 6770
Grams: Gilgalbert, Cent, London

STEELE-SHAW
PEBBLE MILLS

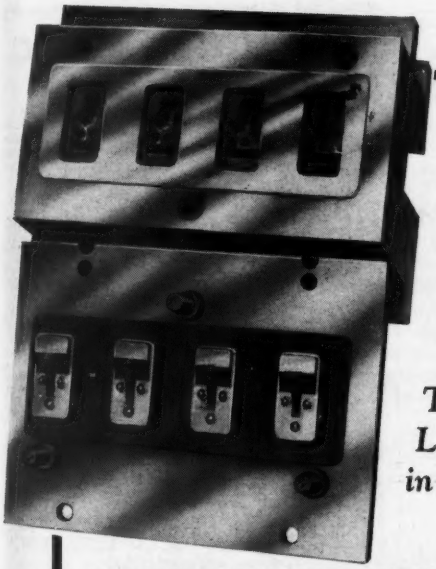
For the grinding of all kinds of Powders, Chemicals, Minerals, Colours, Paints, Enamels, etc. Supplied lined with hard Porcelain, Silex or special linings, and can be insulated to suit particular classes of work.

Send for our free illustrated literature.

STEELE & COWLISHAW, LTD., *Engineers* (Dept. No. 27), Head Office and Works: **COOPER STREET, HANLEY, STOKE-ON-TRENT.**

London Office: 329, High Holborn, W.C.1.
Telephone: Holborn 6023.

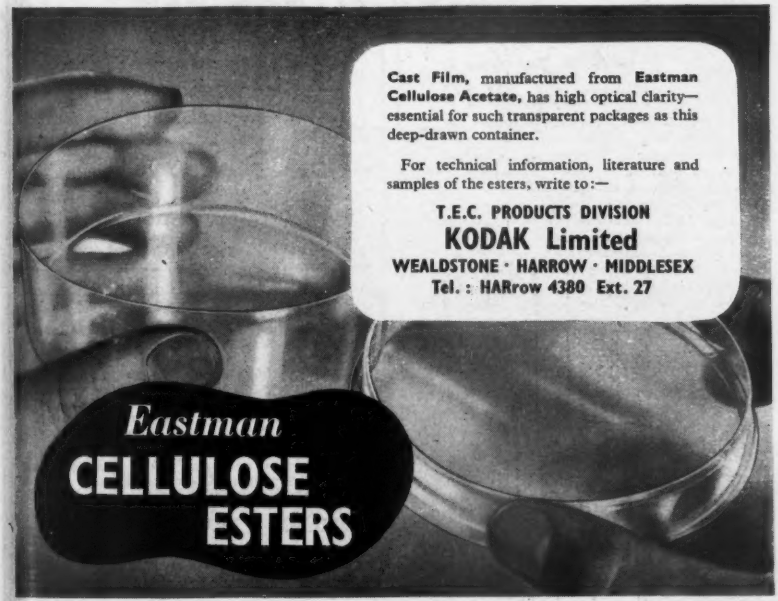
Nearly ¾ a Century's Experience in Grinding



ACCURACY
•
PRECISION
•
RELIABILITY

The Keynotes of LAW Craftsmanship in PLASTIC MOULDS

F. W. LAW & SON LTD., MANCHESTER RD., ROCHDALE, LANCS.


Cast Film, manufactured from Eastman Cellulose Acetate, has high optical clarity—essential for such transparent packages as this deep-drawn container.
For technical information, literature and samples of the esters, write to:—
T.E.C. PRODUCTS DIVISION
KODAK Limited
WEALDSTONE · HARROW · MIDDLESEX
Tel. : HARrow 4380 Ext. 27
Eastman
CELLULOSE
ESTERS

PLASTICS DICTIONARY.

By Thomas A. Dickinson. This is a most useful book for plastics technicians. It gives full definitions of about 3,500 terms commonly used in the industry, and includes illustrations. Various tables and charts are provided, comprising practical data on catalysts, chemical elements, fillers, pigments, plasticizers, solvents and other items.

25/- net.

PITMAN

Parker Street, Kingsway, London, W.C.2

Our New Year Wish for You is

Peace in 1949

The wish being father to the thought, our opinion (for what it is worth) is that we SHALL enjoy peace in 1949. Let us therefore order our affairs with imagination and enterprise. Let us be bold but prudent. That is our policy — one of continuing expansion and ever-widening service to the many thousands of Gosheron tape users throughout the world. Our aim is to make the name Gosheron consonant with all that is best in British business: fair dealing with our customers and good conditions for our workers. That, we believe, is real private enterprise, and for your support we shall always be deeply grateful. For your past considerations, we express the feelings of all who work in the Gosheron organisation by saying a very warm and sincere "Thank you!"

GOSHERON for TAPES

Transotape self-adhesive cellulose tape . Tex-o-tape self-adhesive cloth tape . Colortape — made from cotton yarn brilliantly dyed. Fortefix laminated paper strapping — the new BIG idea!

Samples and information gladly

JOHN GOSHERON & CO LTD

GAYFORD ROAD LONDON W12

TELEPHONE: SHEPHERDS BUSH (SHE) 3326

SUPERIOR P.V.C. SHEETING

Plain and Printed. Transparent, Metallic and Opaque ranges. Approximately 5/1000" and 7/1000" by 36" wide on 40-yard rolls. Excellent welding qualities. Remarkable strength. Uniform consistency. Prices and samples on request.

Also non-tacky Frosted 36 in. x 100 yards ·007/8 in.

PHENCO FLOOR COVERING

Nominal 36" wide by 3'32" by 12-yard rolls. Plain brown or black, brown/white or black/white marble effect and other colours. Fire resistant. Damp resistant. Oil and grease resistant. Hygienic. Non-skid. Durable and lasting. Easily washed or polished. Keeps heat in and cold out. Economical in price. Soft to the tread. Sound absorbing.

12 in. x 12 in. tiles also available.

Agents required.

Your enquires invited

G·R·L PLASTICS LTD.

5/8 ST. ERMIN'S (WEST SIDE), CAXTON STREET, WESTMINSTER, LONDON, S.W.1

Telephone: WHitehall 1878/79/70

PLASTIC MOULDINGS AND CASEIN TURNINGS

To your particular requirements

FREDERICK W. EVANS, LTD.
PLASTIC WORKS, LONG ACRE, BIRMINGHAM, 7.

TELEPHONE:—EAST 1286 and 1287

WANTED—STOCKS for CASH

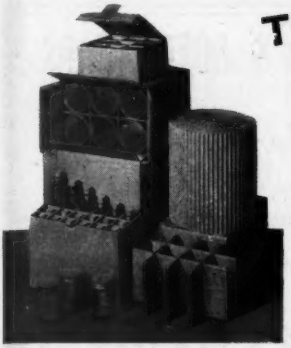
WE are cash buyers of merchandise of every description. Also Clearance Stocks, Discontinued Lines, Surplus Stocks; in fact, goods of all kinds can be disposed of through us, without delay, on the most favourable terms, and without trouble.

SHOULD you have anything for disposal, either now or at any future time, please send us samples, full particulars and price on a cash settlement basis.

RELIANCE TRADING COMPANY

Wholesale Warehousemen and General Merchants

13, New College Parade, Finchley Rd., London, N.W.3



THE CORRUGATED PACKING MATERIALS CO. LTD.

May we quote for

SINGLE-FACED CORRUGATED ROLLS, SHEETS, PIECES AND TUBES

•

DOUBLE-FACED CORRUGATED BOARDS, BOXES, CONTAINERS & CARTONS?

ENQUIRIES TO:—

CORRUGATED PACKING MATERIALS (SALES) LTD.

MANCHESTER, 3 35, Byrom Street, Deansgate. (BLA 1937.)	**BIRMINGHAM** Grove House, Cranemore Street, Nechells. (EAS 1383.)	**BRISTOL** Little Avon Street, Bristol, 2. (24317.)	**LONDON** 59, Kennington Rd., S.E.1. (WAT 6453.)

Technically Perfect Mouldings . . .

for the — **Aircraft, Engineering, Electrical** and **Fancy Goods** Trades

RM SERVICE and DEPENDABILITY

ROOTES

Mouldings Limited

SLOUGH, BUCKS Telephone: Slough 22349

PLASTIC COSMETIC CONTAINERS & BOTTLE CAPS

BY

P. S. Banarse and Co. (Products), Ltd.

FOR EXPORT AND HOME MARKET

176, GOLDERS GREEN RD., LONDON, N.W.11 — 'Phone: SPEEDWELL 5222

34, MOZART ST., QUEENS PARK, W.10 — 'Phone: LADBROKE 0239

'Grams: BANARSE, GOLD, LONDON

Introducing **BONDTITE A** ADHESIVE

Write or phone for this folder

A NEW Holdtite PRODUCT

Sample on request

BONDS - WOOD, PHENOLICS, BRICK PAPER, METALS, LEATHER GLASS and many other materials

SURRIDGE'S PATENTS LTD.
NEW WORKS, CROYDON ROAD, ELMERS END
BECKENHAM, KENT. 'Phone: Beckenham 0168

W. B. COLDWELL & SONS LTD.

DIESINKERS, MOULDS, JIGS.

DIPLOMA FOR DIE SINKING 1911

89-91, Rockingham Lane,
SHEFFIELD, 1.
TELEPHONE. SHEFFIELD 24047

STEADY PINS

to the specific requirements of our customers

Makers of all types of repetition products from the bar in all metals

M·C·L AND REPETITION LTD.
POOL LANE · LANGLEY · BIRMINGHAM

Compactly presented information

PLASTICS MANUAL
By H. R. Fleck, M.Sc., F.R.I.C.

"More informative, considerably easier to read than many more ambitious and expensive volumes."—*The Industrial Chemist.*

"An acceptable source of compactly presented information for all technologists who make or use plastics."—*Engineering.*

Obtainable from all booksellers and bookstalls, price 15/- net, or 15/6 post free from

TEMPLE PRESS LIMITED
Bowling Green Lane, London, E.C.1.

BYSON FOR BAKELITE
Acetate and other Synthetic Mouldings. Modern Plant and Facilities

APPLIANCE Co. LTD
WOOLFOLD, BURY, LANCS.
Telephone: Bury 1560-1 Telegrams: "Bysonite, Bury."

G.P.U.

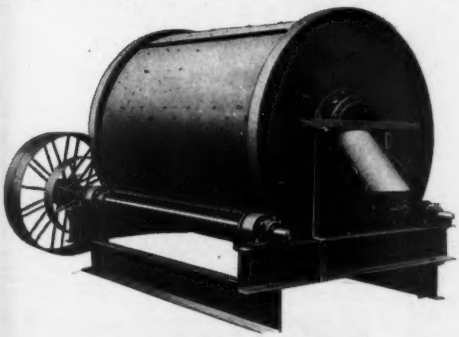
offer a wide range of General Power Units including Motors, Generators, Transformers, Engines, and in particular any "Specials" for the individual requirements of the Plastic Industry . . .

THE ELECTROPLANT CO.
(Established 1912)
Palace of Engineering, WEMBLEY

'Phone: ***WEMbley 6061 (5 lines)***
'Grams: ***" Powaguide, Phone, London."***

GPU GROUP

THE UNIVERSAL REVOLVING DRUM MIXER



USED THROUGHOUT THE INDUSTRY FOR THE ACCURATE AND QUICK BLENDING OF COMPOUNDS

Capacities :

Cu. ft.	Cu. ft.	Cu. ft.
35	**65**	**100**

SELF-EMPTYING

SPECIAL FEATURES

The mixer feeds and discharges by one movable spout. There is no stopping for charging or discharging. The dual purpose spout automatically changes position when its locating pin is moved.

Access to the inside of the drum is easily obtained by removal of the large inspection door.

It takes little power to drive and can be stopped or started up under load.

The mixing action is gentle without beaters or worms. It is rapid, as the drum revolves while the charge is being fed in.

J. BOOTH & SON LIMITED
PROVENDER MILLING ENGINEERS
CONGLETON CHESHIRE ENGLAND
TELEPHONE :– CONGLETON 149

Synthetic Resin Papers

for **LAMINATION** & **TUBE WINDING** in all substances

★ *Why not discuss possible uses?*

HENRY and LEIGH
SLATER
Branch of
THE ASSOCIATED PAPER MILLS LTD.
BOLLINGTON
near **MACCLESFIELD**

MAKERS OF ALL TYPES OF
WOVEN WIRE
WIRE CLOTH
WIRE SCREENS
WIRE GAUZE
WIRE MESH
IN ALL METALS

BRASS
COPPER
BRONZE
MONEL
STAINLESS
NICKEL
TINNED
GALVANISED
STEEL
ALUMINIUM
ALLOYS, ETC.

SIEVING
FILTERING
SCREENING
STRAINING
FOR ALL INDUSTRIAL & DOMESTIC USES

THE UNITED WIRE WORKS LTD.
GRANTON, EDINBURGH, 5
'Phone: 83245 P.B.E. 'Grams: SCOTIA, PHONE, EDINBURGH

Pioneers!
in MOULDS for
MODERN PLASTICS
also Press Tools,
Jigs and Gauges.
BARBER & DUFFY LTD
214/222, Cardigan Road, LEEDS.
Telephone: LEEDS 52033
Member of the Gauge and Toolmakers' Association

Clarke's MULTI-PURPOSE TOOL
"THE ENGINEER'S GOOD COMPANION"
This high-speed Tool Cuts, Grinds and Polishes. Has many Tool Room and Production uses.
Send for Leaflet X32.
A HAND MACHINE TOOL
RUNBAKEN - MANCHESTER - 4

CLASSIFIED ADVERTISEMENTS

Rate 4d. per word, minimum 4/-
1-inch semi-displayed space, 50/-
— Box Number Fee, 1/- —

Instructions should be addressed to "Plastics," Bowling Green Lane, London, E.C.1

AUCTIONEERS' ANNOUNCEMENTS

RICHARDS AND PARTNERS.
AUCTIONEERS, VALUERS AND SURVEYORS
of
INDUSTRIAL PROPERTY, PLANT AND MACHINERY,
GRANVILLE HOUSE, ARUNDEL STREET.
LONDON, W.C.2.
Phone, Temple Bar 7471 (four lines).
zzz-203

BUSINESSES, PREMISES, OFFICES, ETC.

Wholesale Plastics, fancy goods, toys, stationery, etc. South Coast. Entire company shares, goodwill, etc., £2,000, stock and equipment at valuation approximately £2,000. Main road office and showroom. Valuable agencies with facilities for production to specifications. Owners going abroad. Box P403, care of "Plastics." 140-x342

Businesses, Premises, Offices, etc.—Wanted

Factory premises required in Greater London area, 30,000-40,000 sq. ft. Box 6540, care of "Plastics." 140-533

DESIGN AND DRAWING

Design and drawing capacity for plastic moulds (injection, compression, transfer), and component design development, Graystone Designs, 35 Winchester Road, Hampstead, N.W.3. Phone, Pri 7420. zzz-237

Specialists in tool design and injection moulding offer their many years of practical experience to designers and patentees of new articles, or will advise firms or individuals requiring assistance in moulding and marketing of ideas. Box P3920, care of "Plastics." zzz-244

MACHINERY, TOOLS AND PLANT

Alternators, Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings, ex stock. Keen prices. Contact G. L. Murphy, Ltd., Menston, near Leeds. zzz-210

Twelve plating vat ramblers by Cruickshank, 18-in. diam. by 21 in. deep, belt driven, £25 each. Thompson and Son (Millwall), Ltd., Cuba Street, London, E.14. zzz-234

The Electroplant Co., Wembley, for any type of special duty electric plant, specialities converters, gen. sets, electrical test equipment; ask for production range. 140-541

Die sinking machine, as new, type 3 D.S. Taylor Hobson 3-dimensional. £340. Box P3921, care of "Plastics." 142-586

Two Bradley and Turton 3-throw vertical hydraulic pumps, 2.8 g.p.m., 3,000 p.s.i., each with 8 h.p. ECC slipring motor and Igranic automatic contactor starter.
One Bradley and Turton, 3 ins. diameter by 6 ft. stroke, deadweight accumulator, 1¾ gallons, 3,000 p.s.i., to work with above, £575.
One Bradley and Turton accumulator, 7 ins. diameter by 7 ft. 6 ins. stroke, 12½ gallons, 450 p.s.i., £65. Seen running at Birmingham.
Abelson and Co. (Engineers), Ltd., Coventry Road, Sheldon, Birmingham. 94-96 Grosvenor Street, Manchester. 333 Station Road, Harrow, Middlesex. 140-580

Quantity of rubber spreading machines by Platt Bros. and Co., Ltd., complete with hoods and in good condition. Roller width 60 ins. Apply, Woodfield and Turner, Parsonage Mills, Burnley. Phone 3065. 142-580

Two die-casting machines, goose-neck type, hydraulic operation with gas-fired furnace and motorized pump, one automatic and one semi-automatic, 8 lb. capacity, by the French Oil Co., U.S.A., good condition.
W. Urquhart, 1023-7 Garratt Lane, London, S.W.17. zzz-242

Machinery, Tools and Plant (contd.)

Shaw hydraulic accumulator, 120 tons cast iron weight loaded type with three throw pumps, not A.C. 415/3/50, latest design, as new.
Two Shaw hydraulic presses, 60 tons, four columns, platens 3 ft. 6 ins. by 4 ft., daylight 6 ft. 6 ins., as new.
Ingersoil-Rand horizontal compressor, 100 cubic ft. per min., not A.C. 415/3/50.
W. Urquhart, 1023-1027 Garratt Lane, S.W.17. Bal 3351. 145-593

Compact vertical injection machine, capacity 1½ oz., complete with air compressor, motor A.C., air bottle and bench. In perfect condition at a reasonable figure. For details, write Box P406, care of "Plastics." 140-13

For sale. One Edgewick Type A injection moulding machine, complete with compressor, air bottles, piping, etc.,; unused. For further particulars, write Box P4015, care of "Plastics." 140-17

Small injection moulding installation, comprising three ½-oz. vertical machines, benches, Broom and Wade compressor, motor, two air storage cylinders, etc. Box P401, care of "Plastics." 140-x341

Machinery, Tools and Plant Wanted

Wanted, Stokes and Gotz plastic moulding presses. Conditions and price to Box 6541, care of "Plastics." 140-534

Moulding Powder Plant. Small production plant wanted urgently. Hot mixing rollers, ball mills, experimental moulding press, etc. Plastic Research Laboratories, 126 Torrington Park, North Finchley, N.12. 140-8

Surplus injection moulds, for use on 1-oz., 2-oz and 8-oz. machines required. Details, samples and price to Box No. P4019, care of "Plastics." 140-19

Wanted, mould for 7¼-in., 7¼-in., deep-top comb. Submit price, together with details of condition of mould and samples. Box P4017, care of "Plastics." 140-18

NOTICES

The Trade Mark No. 550,468 consisting of the word "SCARAB" and registered in respect of moulding competitions, not included in other Classes, setting under heat and/or pressure and sold in the form of powder, granules, rods, tubes, sheets, slabs or blocks, was assigned on the 1st December, 1948, by THE BEETLE PRODUCTS COMPANY, LIMITED, of 1 Argyll Street, London, W.1, to BRITISH INDUSTRIAL PLASTICS, LIMITED, of the same address, WITHOUT THE GOODWILL OF THE BUSINESS in which it was then in use. 140-6

PRODUCTION CAPACITY AVAILABLE AND WANTED

Dohm, Ltd., pulverize raw materials everywhere. 167 Victoria Street, London, S.W.1. zzz-224

Injection moulding specialists have moulding capacity up to 4 oz. Consultants on all injection moulding problems. Please send inquiries to Box 5328, care of "Plastics." zzz-236

Injection moulding capacity available on 3-oz. injection moulding machine for short and long runs. Box 5327, care of "Plastics." zzz-235

P.V.C. silk screen printing. Table cloths, curtains, nursery patterns, etc. Capacity available for quantity runs. Quality work. Daily deliveries. Guaranteed adhesion and fastness of colour. Davis (Patents), Ltd., 18 Phipp Street, London, E.C.2. Bishopsgate 2939, 5091. 143-538

Capacity available for plastic injection moulding. Various powders in stock. Long or short runs entertained. Write, Taylor Page, Ltd., 55 Gordon Square, W.C.1. Phone, Mus 8785. 141-x8095

Repetition in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple Street, Rugby. 149-543

Capacity. Presswork up to 50 tons (Turner presses), long or short runs. Expert operators. Greenwood, Rawlins and Co., Ltd., 76 Milton Street, Southend, Essex. 141-582

Firm in the North-west London area will have capacity to undertake injection and compression moulding work in the New Year, personal attention given to all work, at competitive prices. Box 6996, care of "Plastics." 140-x122

"Impossible" moulding propositions invited by pioneer injection moulders with unusually qualified staff and most modern capacity up to 12 oz. Inquiries in strict confidence and without obligation. Box P6559, care of "Plastics." 140-22

Production Capacity Available and Wanted (contd.)

Injection mouldings in therm-plastics. Mouldings in styrene, acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited. J. and E. Courtnay, Ltd., 138 Stratford Road, Birmingham, 11. 141-x598

—RAW MATERIAL AVAILABLE AND WANTED—

Cork! Cork! British Cork Mills, Ltd., 167 Victoria St., London, S.W.1. Vic 1414-6. zzz-238

Buna-plast, a blending of synthetic rubber and P.V.C specially processed for manufacturing leather substitute; this material is far superior to plasticized P.V.C., inquiries welcomed. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-230

P.V.C. calendering compound in a range of opaque colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-229

Polystyrene moulding scrap urgently required, state amount available and send small sample. Box 3185, care of "Plastics." zzz-228

1st quality virgin cellulose acetate moulding powder available. Box 3184, care of "Plastics." zzz-227

Polythene moulding powder (reconstituted) in black natural and a variety of colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-226

MOON AIRCRAFT, LTD.,
SPECIALISTS IN MANIPULATED AND FABRICATED WORK.
• OFFICIAL I.C.I. STOCKISTS FOR PERSPEX.
Have available from stock all thickness in clear and colour flat sheet cut to customer's sizes.
Inquiries, prices and particulars upon application to
CLIFT WORKS, BOX, WILTS.
Phone, Box 188.
London Office:
GROSVENOR GARDENS HOUSE, S.W.1.
Phone, Victoria 9182-3. 144-592

Metal powders and oxides. Quotations and samples on application Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-225

Perspex acrylic sheet.
Large range of colours from 1/16-in. to ½-in. Large stocks, good delivery.
J. H. Berry (Plastics), Annesley Woodhouse, Notts. Phone, East Kirkby 2151. 140-569

Reclaimed X-ray Sheet, blue tinted. Sizes 6 ins. by 4 ins., 8½ ins. by 6½ ins., 10 ins. by 8 ins., at 1s. 9d. per lb. in 1-ton lots; size 12 ins. by 10 ins., at 2s. per lb. in 1-ton lots; size 15 ins. by 12 ins., at 2s. 6d. per lb., in 1-ton lots; size 17 ins. by 14 ins., at 3s. per lb., in 1-ton lots. Intermediate sizes also available. Delivery from stock.
Reclaimed nitrate X-ray sheet, various sizes, at 1s. 3d. per lb., in 1-ton lots; 5 tons available.
Scrap Perspex, clear, transparent, various sizes, thicknesses and shapes, 1s. per lb., in 1-ton lots; 5 tons available.
Plastic scrap, very mixed assortment, colours and shapes, 6d. per lb., in 1-ton lots; 5 tons available.
Acetate flakes, clear, transparent, 9d. per lb., in 1-ton lots.
Clear transparent acetate sheet film, 10 ins. by 6 ins., 10-thou. thick, brand-new material, 3s. 6d. per lb., in 1-ton lots.
Lloyds, 4-5 Church Street, Christchurch. Phone, Christchurch 504. zzz-241

1-16-in. clear "Perspex" for sale, 48 by 36, 4s. sq. ft., minimum 10 sheets, £24 delivered. P.D.I., Ltd., 54 Snow Hill, Birmingham, 4. 140-3

Polystyrene scrap and moulding powder wanted urgently. Dohm, Ltd., Plastic Div., 167 Victoria Street, 140-7

Cellulose-acetate extrusion capacity available. Electrical and General Accessories (Leicester), Ltd., Holyhead Road, Wednesbury, Staffs. 140-9

Cellulose-acetate tube available in large quanities in the following sizes:—½-in., ⅝-in., ⅞-in., 1-in. outside diameters. Address inquiries to Box P4013, care of "Plastics." 140-15

Raw Material Available and Wanted (contd.)

Ebonite and bakelite always in stock. Phone, Archway 3654. A. E. Goodeve, Ltd., 188a Seven Sisters Road, London, N.7. 151-634

Spray and brush. Waterproofing, all colours, for acetone, acrylic and PVC samples from Lakeland Ink Co., Barrow-in-Furness. 145-636

Powders. C.A., assorted colours, Bakelite and scarab black, 6 cwt. each. Box P402, care of "Plastics." 140-x341

One ton white opaque polystyrene required urgently with repeat. Offers. Box P405, care of "Plastics." 141-637

Urgently required, 4-mm. flesh-pink and shell cellulose-acetate optical sheeting, paid up to 12s. and 15s. per lb. respectively. Box P4020, care of "Plastics." 140-633

Accurate powders for ceramic, alloy, plastic, paint, etc., industries. Dohm, Ltd., Pulverisers, 167 Victoria Street, London, S.W.1. 140-536

Laminated bakelite offcuts, 1/16 in. thick, for sale. Five tons available at low figure. S. G. Young, 154 Blackfriars Road, London, S.E.1. 140-x637

Scrap. Why not let a well-established firm quote you for cellulose acetate, polystyrene and other thermoplastic off-cuts and scrap? Having best use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plastics), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. 140-21

D. H. Ridout and Son, Ltd., Reg. Office, 12 Stedman Road, Southbourne, Bournemouth. Phone, Southbourne 505.
Official stockists for I.C.I. acrylic Perspex, crystal and coloured, and "Crinothene" sheeting in all shades.
Offer acetate and celluloid transparent sheeting from 2s. per lb.
Bakelite laminated sheeting from 1s 10d. per lb.
Coloured and clear Perspex off-cuts at 1s. 3d. to 2s. per lb. according to gauge and quantity required.
All types of plastic tubes and rod from 4d. per foot.
1¼-in. ribbed plastic belting at 6d. per yard.
Perspex No. 6 and No. 2 quick-drying cements and polishes.
Special offer of 1-oz. and ½-oz amber bottles with plastic screw stoppers at 15s. per gross.
Send for new stock list which contains numerous interesting items to opticians and manufacturers of finished plastic goods.
Surplus stocks purchased.
D. H. Ridout and Son, Ltd., Stedman Road, Southbourne, Bournemouth. 140-2

2,000 sheets (56-in. by 25-in.), 40 thou., weight per sheet 2¾ lb., transparent acetate to clear at 4s. per lb.
3 tons reclaimed X-Ray, 10 thou., 15 by 12 and 10 by 12 at 2s. 5d. per lb.
We hold large stocks of acetate in clear and colours, 3 thou. to 40 thou.
Allans, 37 Farringdon Street, London, E.C.4. Central 5947. 140-10

Always large stocks of
CASEIN
rods, tubes and sheets,
PERSPEX
sheets up to 1-in. thick
CELLULOSE ACETATE.
S. Rosenfeld,
93 Aldersgate Street, E.C.1
Phone, Monarch 4686 146-59

Raw Material Available and Wanted (contd.)

Perspex. R. Denny and Co. Stocks available for immediate delivery. Sheet or cut to specification inquiries invited for display stands, panels, windows, windscreens, etc.; quotations by return. 5a Oxford Road, Ealing Broadway, London, W.5. Ealing 6351 141-0429

Laminated bakelite offcuts, 1/16-in. thick, for sale. Five tons available at low figure. Box 6831 care of "Plastics." 140-x9603

Cresylic acid, few tons available, grades A and B, surplus to requirements. Box 6554, care of "Plastics." 140-540

Perspex off-cuts (large) required, clear and coloured. Please write Occupational Therapy Supplies, Marion Parade, Tooting, S.W.17. 142-579

Require urgently, Polystyrene Powder Virgin or regrounded, all colours. Good price paid. Reply Box P360, care of "Plastics." 141-584

Celluloid-nitrate sheets, 20-000 in. thick, in transparent clear, perfect condition, large quantities, wanted immediately. Offers to Box P3910, care of "Plastics." 141-585

Wanted paper-covered transparent 5/32 Perspex, to cut approx. 15 ins. by 19 ins. About 500 sq. ft. Box 6995, care of "Plastics." 140-x128

SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50, inclusive, or a women between the ages of 18 and 40, inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

Calender man wanted with an all-round experience on P.V.C. sheeting and fabric coating. House available to a suitable applicant and the rate of pay will be 3s. per hour with opportunity of overtime. Apply giving full details of experience, age, etc., to Box 6537, care of "Plastics." 140-531

Extruder wanted for the West, with all-round experience on varied sections for the motor car trade. Good pay and conditions with excellent prospects of promotion for the right man. Apply stating age, experience, etc., to Box 6538, care of "Plastics." 140-532

Mould-maker—Die-sinker in hard and soft metals wanted by old-established firm producing blown toys and fancy goods in thermo-plastic materials. Excellent opportunity and permanency for good man. Apply Box P4016, care of "Plastics." 141-643

Works manager required for old established company near London. Only applicants with experience in the plastic industry and knowledge of administration and production control would be considered. Applicants should be under 40 years of age. Fullest particulars, salary, etc., to Box P407, care of "Plastics." 141-638

Works chemist required by plastic moulders principally interested in thermosetting materials. Only applicants with honours degree who have had experience in the industry and who are under 40 years of age will be considered. Fullest particulars, salary, etc., to Box P408, care of "Plastics." 141-639

Chemical engineer required by large firm of plastic moulders near London to take charge of development. Only applicants with experience in the industry who are under 40 years of age will be considered. Full particulars, salary, etc., to Box P409, care of "Plastics." 141-640

Situations Vacant (contd.).

Senior mould designer required for the plastic industry. Experience and design of compression and transfer type moulds who will act at the same time as plant superintendent of a tool room. Only men with extensive experience in this class of work need apply in writing, stating experience, age and salary required to Box P4010, care of "Plastics." 141-641

Working foreman required for tool room. Fully conversant with production of compression and transfer-type moulds for the plastic industry. Only men with extensive experience in this class of work need apply in writing, stating experience, age and salary required to Box P4011, care of "Plastics." 141-642

Charge hand required for mould shop. Experience in mould making, diesing and hobbing essential. Staff position with good prospects for right man. S.W. London district. Box P4012, care of "Plastics." 140-14

Staff charge hand required with experience of mould making, die sinking and webbing. £10 to £11 per week according to experience. Apply Projectile and Engineering Co., Acre Street, Battersea, S.W.8. 140-12

Qualified Chemist required for laboratory investigations plastics development, particularly problems relating to manufacture of plastics films and coatings, B.Sc. or equivalent, experience with plastics not essential provided applicant keenly interested in this field of research, permanent appointment offering scope for initiative carrying good salary, there is a staff pension fund (contributory) and canteen services. Apply initially in writing quoting reference No. 2199 (essential) to the Personnel Officer, May and Baker, Ltd., Dagenham, Essex. 140-5

An energetic man required to take charge of departments for the manufacture of wooden and plastic products in an established factory with a view to their expansion. Engineering and managerial experience essential. Write stating age, experience and qualifications to E. Gomme, Ltd., Spring Gardens, High Wycombe. 140-4

Experienced plastic salesman required for London and southern England for permanent position with good prospects, will applicants give particulars about previous experience, references and salary required, applications will be treated in strict confidence. Please write under Box P4018, care of "Plastics." 140-20

Fully experienced technician with practical experience of all branches of compression and injection moulding, must have thorough knowledge of designing moulds, and able to cost and estimate, good salary for right man, excellent prospects. Apply Lustroid, Ltd., Coatbridge. 140-1

SITUATIONS WANTED

Plastics engineer, age 42, apprenticeship as toolmaker, many years drawing office aned productive experience in compression and injection moulding, would appreciate change with good prospects. Box P4014, care of "Plastics." 140-16

Mould'ng production foreman or manager, very long practical experience requires similar position home or overseas, excellent references. Box P404, care of "Plastics." 140-x563

TIME RECORDERS

Factory time recorders. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., 157-159 Borough High Street, S.E.1. 149-544

TUITION

MIDDLESEX COUNTY COUNCIL EDUCATION COMMITTEE.

ACTON TECHNICAL COLLEGE, HIGH STREET, ACTON, W.3.

A series of ADVANCED COURSES ON PLASTICS have been planned to take place during the Session 1948-49. The courses, which are part-time, will extend over two years and will cover the requirements for the Associateship of the Institute of Plastics.

1. TECHNOLOGY OF PLASTIC MATERIALS. Thursdays, 6.30 p.m. (This course commenced in November, 1948, and will continue on Thursday, 6th January, 1949.)
2. CHEMISTRY OF PLASTIC MATERIALS. Fridays, 2 p.m. To commence on Friday, 7th January, 1949.
3. PLASTIC TOOL AND MOULD DESIGN. Tuesday, 6.30 p.m. To commence on Tuesday, 4th January, 1949.

The courses are designed for chemists and engineers engaged in the Plastics Industry or industries associated with the manufacture and use of Plastic materials.
Fee for courses on Chemistry and Technology of Plastics or Plastic Tool and Mould Design and Technology of Plastics, £1 7s. 6d.
Full particulars and registration forms may be obtained from the Principal.

T. B. WHEELER,
Chief Education Officer.
140-11

TOOL SERVICE

For quick repairs and the supply of new cutters, routing fixtures, etc., send your inquiries to Neolite, Ltd., Tool Department, Dallow Road, Luton, Beds.
143-635

MISCELLANEOUS

Engraved name plates, scales, dials, etc., supplied. Tickets and Co Box 2, Silver Street, Leicester.
141-5699

Extend Your Trade.
Use a Trade Mark. Consult
Trade Mark Protection Society,
12 Church Street, Liverpool. 142-6036

Photography by Behr will show your products at their best. Ask for illustrated list. 44 Temple Fortune Lane, London, N.W.11. Speedwell 5298. 145-312

Monomarks. Permanent London address. Letters redirected, 5s. p.a. Write, Monomarks, BCM/MONO76, W.C.1. 140-373

Packing cases and boxes for all purposes. F. Rawle and Co., Ltd., 71 Kensington Avenue, London, E.12. Phone, Grangewood 2003. 147-441

A skilled team of engineers and fitters available for outside erection or dismantling, survey, inspections, etc., of large power plant of any description. For details write to G.P.U., Ltd., Service Division, Wembley. 140-542

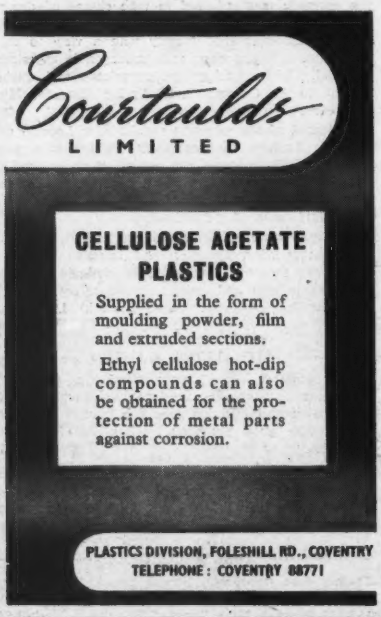
WARNING NOTICE.
" GUMSTRIP "

is the Registered Trade Mark (No. 568652) of Samuel Jones and Co., Ltd., and its use in connection with sealing tapes or adhesives or gummed paper tape other than that supplied by Samuel Jones and Co., Ltd., is an infringement.

Appropriate action will be taken in all cases which come to the proprietors' attention of the use of this Mark in connection with goods other than those manufactured by Samuel Jones and Co., Ltd.
147-583

One-piece calendar sets, celluloid perpetual change dates, engraved nameplates, scales, dials, etc., ivorine. Tickets and Co., Plastic, Leicester. 149-537

Huts, Nissen type, reconditioned, 30-ft. span, 24-ft. span and 16-ft. span, any length; these huts are repaired, painted and completely reconditioned. Prompt dispatch. Also other industrial buildings, suitable for workshops, stores, garages, canteens, offices, etc. Write, phone or call for details. J. Thorn and Sons, Ltd., Box 138, Brampton Road, Bexleyheath, Kent. Phone, Bexleyheath 305. zzz-243


Courtaulds
LIMITED
CELLULOSE ACETATE PLASTICS
Supplied in the form of moulding powder, film and extruded sections.
Ethyl cellulose hot-dip compounds can also be obtained for the protection of metal parts against corrosion.
PLASTICS DIVISION, FOLESHILL RD., COVENTRY
TELEPHONE: COVENTRY 88771

Specialists in TURNED PARTS for MOULDED ELECTRICAL PRODUCTS
DAVIS & TIMMINS
LIMITED
Head Office: Billet Rd., WALTHAMSTOW
LONDON, E.17
Tel: Larkswood 2313 (6 lines)

Printed in England and Published Monthly by the Proprietors, TEMPLE PRESS LTD., BOWLING GREEN LANE, LONDON, E.C.1

949

pplied.
er.
1-5699

2-6036
t their
ortune
45-312
Letters
NO76,
40-373
le and
E.12.
47-441
ble for
s, etc.,
details
bley.
40-542

Samuel
n with
other
Ltd., is

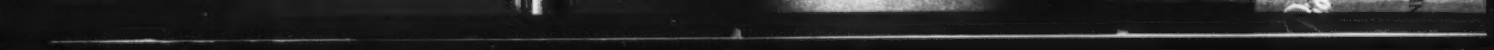
which
of this
manu-

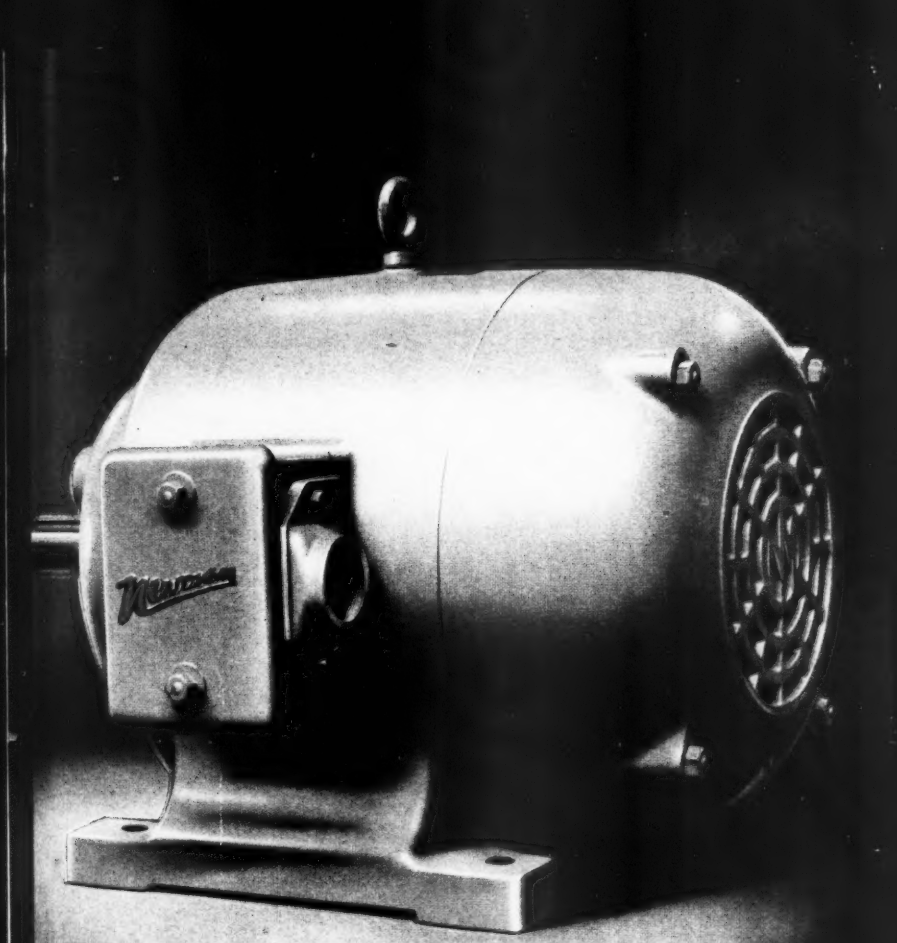
47-583
change
vorine,
49-537
24-ft.
ts are
tioned.
s, suit-
offices.
rn and
wheath.
zzz-243

W

es)

E.C.1





FOR ALL DUTIES

Pioneers in the Universal Application of Totally Enclosed Motors

NEWMAN INDUSTRIES LIMITED, YATE, BRISTOL. London Office: 49, Park Lane, W.1.

Cypsi

JANUARY 49. Vol. XIII. No. 140 **Plastics** TWO SHILLINGS

ERINOID LIMITED

Manufacturers of Modern Plastics Materials

LIGHTPILL MILLS, STROUD, GLOUCESTERSHIRE. Tel: STROUD 810 (5 lines)

London Offices
208A REGENT STREET, W.1
Tel: Regent 0418

Birmingham Offices
3 COLEMHILL ST., BIRMINGHAM, 4
Tel: Birmingham Central 1116

ILLINGS
lines